FACTORS INFLUENCING THE ADOPTION OF AGRICULTURAL VALUE CHAIN ENTERPRISE SOLUTIONS ON PRODUCTIVITY IN KENYA: A CASE OF EDENSYS ENTERPRISE SOLUTION IN MAKUENI COUNTY

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DECLARATION

This project is my original work and has not been presented for award in any other University.

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L50/82894/2015

This project has been submitted for examination with my approval as the University supervisor

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DEDICATION

This research study is dedicated to my mother Evelyn Mwikali and my siblings.

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ABBREVIATIONS AND ACRONYMS

AfrISPA: African Internet Service Provider's Association

APPG: All-Party Parliamentary Group

A4AI: Alliance for Affordable Internet

CIPESA: Collaboration on International ICT Policy in East and Southern Africa

ITU: International Telecommunication Union

FAO: Food Agricultural Organization

KNBS: Kenya National Bureau of Statistics

MIS: Measuring Information Society

UNDP: United Nations Development Program

UN: United Nations

WBG: World Bank Group

ABSTRACT

The research was undertaken to understand why farmers would adopt the use of agricultural value chain enterprise solutions in their daily farming activities. What attributes would make the adoption of these agricultural value chain enterprise solutions desirable in agricultural production? To achieve that, the research reviewed literature for understanding the factors that influenced the adoption of agricultural value chain enterprise solutions in the agricultural ERP context. The preview provided overall insight into prior studies that emphasized on the factors influencing the adoption of agricultural value chain enterprise solutions in agricultural production. A case of Edensys Enterprise Solution in Makueni County was chosen as a reference. The purpose of the study was to examine factors determining the adoption and adoption of such value chain enterprise solutions in agricultural production in Makueni County in Kenya. The study explored research on connectivity of the farmers to the agricultural value chain enterprise solutions, their level of training undertaken to use the value chain enterprise solution, costs involved in using or acquiring the value chain enterprise solution and as well as demographic characteristics of the farmers relating to the use and adoption of the value chain enterprise solution. Multi-stage sampling technique was used in selection of the respondents. Questionnaires with both structured and unstructured questions were used in collecting primary data. Both qualitative quantitative techniques were used to analyze the data obtained from the field. Statistical package for social sciences (SPSS) and MS Excel 2010 was used in data management and analysis. Findings were presented in the form of percentages, frequency tables and graphs. The aim of the research study was to examine the influencing adoption factors of agricultural value chain enterprise solutions also known as agricultural ERPs among farmers in Makueni County, where the main economic activity is small scale farming. The study found out that indeed the examined factors affects how farmers adopt the use of the agricultural value chain enterprise solution in their agricultural production activities. The study concluded the most significant factors as examined were cost of ownership followed by connectivity on a close second then end user training and demographic factors in that order. The study therefore supports the importance of the studied attributes in decision making before adoption of the value chain enterprise solution.

CHAPTER ONE
INTRODUCTION

1.1 Background to the study

The industrialization of agriculture has expanded a lot in the previous decades. Farms are developing towards a high-tech affair that is characterized by large scale production and intensive use of technology. Farms should not only be very efficient, but also have to meet high quality and environmental standards and should adapt flexibly to changing market dynamics. In this complex and often turbulent business environment, it is of great importance to keep business processes in control. This imposes high requirements on the managerial tasks in agro-food business and consequently on the supporting information systems, particularly regarding flexibility, integration and incorporation of intelligence for advanced decision making (Sørensen et al., 2010; Wolfert et al., 2010).

It is widely argued that the current information systems in the agro-food sector do not sufficiently meet these requirements (Sørensen et al., 2010; Teye et al., 2012; Lehmann et al., 2012; Kruize et al., 2013; Verdouw et al., 2013). It is under these circumstances that agricultural value chain enterprise solutions also known as agricultural ERPs were introduced in the agro-value chain system and widely implemented to mitigate for this. An ERP system is a standardized software package that combines functionality of multiple business functions into one integrated system (Davenport, 2000; Kumar and Hillegersberg, 2000). ERP helps to overcome fragmentation between processes and outputs hence its main function is automation of processes. As a result, ERP have been employed in the last decade as an effective solution approach for the agro-food sector.

The introduction of the agricultural ERP solution has been actively promoted in agriculture. Although there are efforts to apply the full scale usage of ERP solutions in agriculture, successful cases have been rare because of the limitation of ERP solutions and lack of user's awareness. The agricultural ERP helps in the decision-making of new information by sharing different types of information. In a narrow sense, the ERP solution also denotes its own business software package (J. P. Laudon and K. C. Laudon, 2010). The purpose of ERP adoption is to construct integrated information systems and to enhance

business processes. ERP adoption can simplify and standardize work to reduce stockpiling expenses, reduce payment terms, enhance information sharing and increase sales (H. J. O and S. W Han, 2005). In addition, ERP can strengthen a farm's competitiveness by enhancing consumer response systems, supplying high value information, and constructing a feedback management systems.

ERP systems are applied to different management activities. For the effective operation of an ERP system, it is necessary to consider specific factors in each field. In the case of agriculture, the production, distribution and sales processes are different from processes with the same names in general enterprises or non-agricultural activities. There have been several studies conducted to find ERP's construction schemes, management efficiency, success factors, and successful cases (K. B. Walhovd et al.,2006). However, in the agricultural field, most studies have focused on the expected effects of ERP adoption and the cases of small-scaled agricultural businesses (H. S. Shin, 2007), However, few studies have been conducted to find the success factors of ERP adoption. The purpose of any ERP is to improve competitiveness through the efficiency of management. However, this purpose faces different challenges because of the constraints of ERP technology and the lack of understanding on the part of the developers of agricultural products.

Like most sectors, agriculture is an information intensive engagement, and agricultural ERPs could play crucial roles in facilitating information exchange (Todaro, 2000). The role of information exchange could be visualized from the perspective of development, flow and management of information and ideas in the various links in the entire system of food farming namely pre-sowing, pre-harvesting, post-harvesting, production, marketing and sales management. Agricultural value chain enterprise solutions have been used to revolutionize farming across rural and urban areas all over the world. The agricultural value chain enterprise solutions can empower small and marginal farmers of developing countries, who have poor access to information, especially regarding best farming practices, customers of their produce and markets. In developing countries, the limiting factors for farmers wanting to maximize their farm incomes are poor market linkages, poor farming practices, poor access to quality farm-inputs, services and technology, lack of

information about resources, institutions and extension services. Most farmers also lack real time information about consumers, market demand and changing prices and hence are prone to exploitation by intermediaries in the supply chain.

The growth of organized retailing and global trade, farming is fast becoming a knowledge intensive, commercialized, competitive and globalized sector, making it necessary to rebuild competitive and efficient agro-supply chains to benefit both the farmer as well as the consumer. Owing to the importance of agriculture in the national economy, it is paramount to have accurate, reliable and timely data for informed decision making and proper planning for best agricultural practices.

Farmers could use the agricultural value chain enterprise solutions to inform their customers about the availability of products or discuss and negotiate prices. Other uses for the agricultural value chain enterprise solutions in the sector include; linking with their suppliers of farming equipment, transport services for their produce, pesticides, get real-time weather updates before planting and best farming practices for new trial crops. Farmers also need to regularly link up with those managing their farms to be abreast of the farm conditions. On educational aspects, farmers could learn how to manage farms, formulate farming fields' structure, or manage crop diseases and pests, by liaising with the agricultural value-chain solutions and fellow farmers. Challenges might develop at any time and farmers need to reach their Agro-vets to either visit the farms or supply information about what could be done to manage the situation. Farmers could visit the ERPs, on a computer, tablet or the mobile phones or any other instant messaging devices to seek for information about what to do.

The extensive use of technology and especially agricultural ERPs in farming has found its way in many countries across the globe and has helped improve productivity of the sector rapidly. India has been one of the leading countries to maximize its agricultural value chain enterprise solutions to improve farmers' yields and this has led to food security coupled with better incomes for the farmers raised the living standards of the people and improved the socio-economic status. According to FAO report on ICT uses for inclusive agricultural

value chains, (2013), there are various agricultural ERP solutions deployed to promote agricultural related information and they gather information through channels such as tele-centers, web portals, call centers, mobile phones, community radio, video, digital photography, GIS, e-mail, audio and video conferencing, and social media applications such as Facebook and WhatsApp to provide the farmers with relevant information needed for their daily farm operations. Agricultural technologies, weather patterns and market information are the key information that are propagated with this medium and are more interactive and engaging between users and the system.

In a global perspective India is one of the countries that relies heavily on agricultural value chain enterprise solutions to streamline their agricultural production processes. For example m-KRISHI , which is an agricultural ERP mobile system used by farmers to access extension services and managed by Tata consulting limited currently operating in the Indian states of Tamil Nadu, Maharashtra and Uttar Pradesh. M-KRISHI provides farmers with information on weather patterns, prices, inputs, and all that they need through a cell phone and web interface, the platform's technology not only allows farmers to receive expert advice, but also provides environment-specific details that give the experts a kind of agricultural map of the issue at hand. For example, when a farmer enters his location on m-KRISHI, agricultural sensors connect to geo-location services like GPS or Google Earth to deliver local weather, soil conditions, common pests and food-grain prices to the expert on the other end. Farmers can also attach photos if they have mobile cameras. m-KRISHI has three versions where one uses voice recognition to receive voice mail questions and assigns ID to each question so that they provide appropriate advice, the second version is in the form of a mobile application where users can interact with it in the system and the last version is an automatic weather station sending updates on the environmental parameters (Abhay N, 2011).

The system has improved farmer's yields, revenue profits and reduced the cost of production which has improved India's food security thereby making the country in line with achieving the United Nations sustainable development goals (SDG's) of 2030. Among the goals being achieved by m-KRISHI in regard to its state of operation are ; SDG 2 of

zero hunger, SDG 1 no poverty, SDG 3 good health and wellbeing and lastly SDG 8 on decent work and economic growth since farmers are able to create more income from a well-structured activity. A journal report by Suresh K Mudda et al., (2016) on A study on the digitization of supply chains in agriculture-an Indian experience also highlights the available Agricultural ERP solutions in India, which provides services such as SMS based portal run by the government of India, others are from the private sector and provide extension services to farmers, advice to farmers, provision of online, detailed content on crops, crop management techniques, fertilizers, and pesticides and other agriculture-related material. Additional services include dissemination of location-specific best agricultural practices to all farmers and an agricultural scientist to provide expert advice using digital photographs of the crops/yields.

Africa has not been left behind in terms of the use of Agricultural ERPs with a variety of such systems being introduced in the market to combat the farming value chain challenges. In West Africa there is E-soko which is an agricultural ERP solution operating in Ghana, E-soko is an agricultural ERP running on a mobile platform linking small-holder farmers to markets across Africa and it provides rural farmers with information such as price information, weather alerts, crop advice and linking buyers to farmers. E-soko in Ghana has gone an extra mile and provides farmers with access to inputs and finance through a virtual market place which subsequently drives business for input dealers and financial service providers. In a regional case there are various agricultural ERP solutions such as M-farm which assists small scale farmers to link up their produce to the market and link up with other farmers. The application empowers the local farmers with transparent prices and market access. M-farm has also developed a group buying tool, allowing farmers to pool their resources to negotiate better prices for things like fertilizer and other farming tools. Experts are now aggressively encouraging farmers to adopt modern agriculture practices and extensive use of the agricultural ERP's as an answer to erratic rains that have affected many parts of the country.

Kenya is widely made up of arid and semi-arid areas, which constitutes 80 per cent of the country's land mass, yet receives little or no rain all year round (Kirbride and Grahn 2008).

The modern practices include agricultural production enablers such as technology to enhance farming efficiency by use of the agricultural ERP's to streamline the farming operations and also guide farmers on how to maximize on their productivity. Information Technology in Kenya is growing very fast. According to the First quarter sector statistics report for the financial year 2015/2016 (2015) by the Communications Authority of Kenya (CA), at the end of the quarter, mobile penetration stood at 88.% with 37.8million subscribers up from 36.1 million in the previous quarter. Other considerable gains were recorded in the Internet market, which registered 21.6 million subscriptions up from 19.9 million in the last quarter. The number of Internet subscribers grew to 31.9 million from 29.6 million in the previous quarter. Consequently, the portion of the Kenyan population accessing and using Internet services reached 74.2 per 100 inhabitants up from 69.0 per 100 inhabitants recorded in the previous quarter. This opens up opportunity for agricultural ERP's to be implemented in the country and provides it with an opportunity for techpreneurs to use the infrastructure and help farmers adopt the agricultural ERP's.

World Bank (WB) report on ICTs for agriculture in Africa (2012) states that African agriculture is largely traditional and practiced by smallholders and pastoralists. The type of agriculture is predominantly rain-fed, has low-yielding production, and lacks access to critical information, market facilitation, and financial intermediation services. The role that agricultural ERPs can play in addressing these challenges is increasing as personal technology devices – such as mobile phones or tablet PCs – are becoming more widely available. Linking agriculture with technology, and embedded in the entire agricultural value chain production systems, can bring economic development and growth as it can help bridge critical knowledge gaps. The capability to use agricultural value-chain enterprise solutions in the food production chain becomes necessary to ensure food production quality, safety and security; however, with millions of small farmers not embracing technology the task is challenging. It is vital to look at connectivity, user-training, costs involved, and demographic characteristics as factors to understand and consider that can affect the agriculture value-chain initiatives for farmers. Therefore understanding how these parameters affect adoption of agricultural value chain enterprise solutions in agricultural production through a case of Edensys Enterprise Solution in Makueni County.

1.2 Statement of the problem

The purpose of the study was to find the influencing factors that affect the adoption of agricultural value chain enterprise solutions that can bridge the gap between technology innovation and agricultural production in Makueni County, Kenya. Makueni County has been experiencing poor farming outputs, which has been attributed to several factors ranging from poor farming techniques, poor storage and transportation of farm produce, lack of essential knowledge and information necessary to aid farming which leads to poor yields and making farming less lucrative and troubling. It has therefore become an imperative for farmers to acquire necessary technology to cushion them from the harsh and unpredictable farming production environment and also acquire a technology edge in the market. It is against this backdrop of an existing gap between technology innovation and agriculture production intensification that formed the basis of this research.

There has been emergence of several agricultural ERPs in Kenya, the adoption and adoption decisions by users have emerged as an important domain of study. Over the last few years, there has been research on success factors and impacts of agricultural ERPs in agricultural production in the overseas countries. However, the research on the adoption factors for agricultural ERPs is very limited in the African and Kenyan perspective. Further, the research concentrated majorly on the users of the agricultural value chain enterprise solutions rather than factors by the system vendors or developers, which was a knowledge gap that the study wanted to fill. Therefore the study attempted to discover the important attributes that farmers consider before implementing the agricultural value chain enterprise solutions in their agricultural production projects, within the Kenyan perspective.

1.3 Purpose of the study

The study was done to investigate factors influencing adoption of agricultural value-chain enterprise solutions in Agricultural production on Edensys ERP solutions in Makueni County.

1.4 Objectives of the study

The objectives of the study were;

1) To determine influence of demographic characteristics of farmers on adoption of agricultural value-chain enterprise solutions in Agricultural production
2) To establish how connectivity influences the adoption of the agricultural value-chain enterprise solutions in agricultural production.
3) To assess how end user-training influences the adoption of the agricultural value-chain enterprise solutions in agricultural production.
4) To establish how cost of ownership influences the adoption of the agricultural value-chain enterprise solutions in agricultural production.

1.5 Research Questions

The study attempted to answer the following questions:

1) What is the influence of demographic characteristics on the adoption of agricultural value-chain enterprise solutions in agricultural production?
2) How does connectivity influence the level of adoption of agricultural value-chain enterprise solutions in agricultural production?
3) How does end user-training influence the adoption of agricultural value-chain enterprise solutions in agricultural production?
4) The influence of cost of ownership on the level of adoption of agricultural value-chain enterprise solutions in agricultural production?

1.6 Assumptions of the Study

A number of basic assumptions were made in this research. They included agricultural value-chain enterprise solutions would influence the performance of agricultural production, farmers were utilizing existing agricultural value chain solutions systems and that respondents filled the questionnaires with honesty and integrity which will enable collection of the data to be unbiased.

1.7 Limitation of the Study

Financial constraints: The research required a good amount of money to ensure that all logistical issues were taken care of; such as provision of stationery in terms of questionnaires. Finances were required to facilitate the movement of the researcher to various projects which were sparsely located. This was overcome by generous contribution of manpower and data by the subject company and also field volunteers from the company. Time limitation: since farmers using the value chain systems were many and due to the time factor limits, the researcher was forced to use a sample from the farmers using the value chain solutions instead of the whole population of the projects.

1.8 Delimitation of the study

The study was designed to investigate the influence of agricultural value-chain enterprise solutions on agricultural productivity in Makueni County. The study only focused on farmers using the Edensys Enterprise Solution which is an agricultural value-chain enterprise solution hence was not focused on other agricultural value-chain enterprise solutions employed by other vendors in Makueni County.

1.9 Definition of Significant Terms used in the Study

Agricultural Value Chain Enterprise Solution:	An automated system that enhances the operation of agricultural systems. It serves to manage production, logistics, finance, sales, purchasing and inventory in an integrated process. It helps in decision making by sharing information and providing relevant information to farmers on how to manage their yields.
Edensys Enterprise Solution:	The organization employing the services of the agricultural enterprise value chain solution in Makueni county.
Connectivity:	The quality, state, or capability of being connected to or communicate with another computer, computer system or a telecommunication system.

End User training:	Is used to distinguish the person for whom a hardware or software product is designed from the developers, installers, and servicers of the product and the training he/she undergoes through before they start to use the system.
Cost of ownership:	Is a financial estimate intended to help buyers and owners determine the direct and indirect costs of a product or system**.**
Demographic characteristics:	Socioeconomic characteristics of a population expressed statistically, such as age, sex, education level, income level, marital status, occupation, religion, birth rate, death rate, average size of a family, average age at marriage.

1.10 Organization of the study

The research is organized in five chapters including the preliminary pages which comprises of the title, declaration, dedication, abstract, acknowledgements, and table of contents, list of figures, and list of tables, abbreviations and acronyms. It also contains the references and the questionnaires at the end of the study. Chapter two covers empirical and theoretical literature on the concept of agricultural ERP systems in farming. The chapter provides a foundation upon which the findings of the study are discussed and conclusions drawn. The chapter finally identifies the knowledge gap from the literature studied.

Chapter three covers research methodology used in the research study, research design, target population, sampling procedure, description of research instruments, validity and reliability of research instruments, methods of data collection, procedures for data analysis, operational definition of variables and ethical considerations. Chapter four has data analysis, presentation and interpretation. Chapter five contains the summary and discussion of findings, conclusion, recommendations and suggestions for further research.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

The chapter presents a review of various relevant literatures on factors that influence the adoption of agricultural ERPs in agriculture. The literature review is guided by the four objectives of the study topic. The various concepts of connectivity, user-training, and costs are discussed along with the demographics characteristics of the population in the study. The chapter is organized into introduction, body and a summary of the chapter. The chapter also contains the conceptual framework of this research and Knowledge gaps from other literatures are also identified in this chapter.

2.2 The Concept of Adoption of Value-Chain Enterprise Solutions in Agricultural Production

Information and communication technologies play crucial roles in every aspect of human development activities today, including agriculture. The key players in agriculture are the farmers and buyers of the farmers produce, and their ability to use the technologies defines the role of technology in agriculture generally. Use of technology by farmers and actors along the whole agricultural production line has increased at a rapid rate globally. In increasing access and exchanging of information, technology offers various advantages among them the potential to increase efficiency, productivity, competitiveness and growth in various aspects of agricultural sector. Farmers that engage in commercial farming in large scale might be expected to be using cameras, computing devices, digital imaging, the Internet and mobile connectivity, Wi-Fi, SMS services, WAP (Wireless Access Protocol) based Internet access using cellular telephony, and digital media and DVD, among others . Those that engage in agriculture in small scale utilize various other forms of technology such as mobile phones, computers, and the internet, etc. (Jonadab, 2015).

Among all agricultural value chain enterprise solutions, the mobile phone is certainly an instrument of choice for many farmers, both large and small scale. Mobile phones are cheap, easy to manage, power efficient and encourages personalized interactions. Mobile phones with installed agricultural value-chain enterprise solution enable farmers to

compare prices more efficiently and to link up with other buyers who were not previously easily accessible. The ease of use of a mobile phone helps the agricultural ERP users to improve the links between farmers and traders, creating opportunities for small-scale producers to sell to new markets, thereby increasing their incomes and helping to reduce poverty in the area. The use of technology in agriculture in Kenya is still evolving, just like in many developing areas. There is some evidence of application at individual levels as well as initiatives at organizational level. However, it is relatively unknown whether the ultimate beneficiaries – the farmers themselves- actually use the facilities to meet their needs. The major problems in adoption of technology such as agricultural ERPs in rural settings are internet connectivity, technology illiteracy, technology devices acquisition costs and lastly the demographic characteristics of people willing to use technology in their day to day activities (N. R. Jere et al., 2013).

2.3 Connectivity and Adoption of Value-Chain Enterprise Solutions in Agricultural Production

This is the capacity to which individuals are connected to an internet platform through platforms, systems or applications. Connectivity in the context of this research study describes the necessary platform needed to access the services offered by the agricultural ERP system which is through an internet connection. Connectivity's main purpose is bandwidth utilization efficiency, which is used to provide services so that users can get higher data rates and wider coverage. However there is no single network that can provide this kind of services. As connectivity makes it vital to use the platform lack of it therefore renders the service impossible to use.

The basic requirement for meaningful use of any web-based tools is to be able to have a stable access to the internet. Information and Communications Technologies can only serve as effective tools of broad-based development and opportunity for all if all people in developing countries can afford access to them (Khalil, 2003). Hesselmark (2003) compared cost of surfing the internet in different African countries and observed that there was some inter-country variation. Some anecdotal reports maintain that internet accessibility for an individual in Africa costs about 300 times compared to that in most

European countries. Mode of accessing internet largely determines cost of bandwidth. According to AfrISPA (2007), the cheapest dedicated one megabyte of bandwidth in Kenya went for US$4,000 (KSh412, 000), compared to South Africa where one megabyte costs US$300 (KShs 309,000). This disparity came about because Kenya accesses bandwidth via satellite links, while South Africa uses fibre optic cables, indicating that bandwidth via satellite is far more expensive than wired bandwidth.

On a global perspective of internet/network connectivity, connections are viewed in different connections type. Machine-to-Machine (M2M) communications is one type of connection that enables networked devices and services to exchange information and perform actions seamlessly without the need for human intervention. They are viewed as a key enabler of the Internet of Things (IoT) and ubiquitous applications, like mobile healthcare, agriculture, or intelligent transport systems. In this context, a machine is a device as opposed to a human. Lack of affordable connectivity and bandwidth is the primary obstacle to several of the most promising agricultural ERP applications for rural areas, including agro-value chain solutions and other real-time diagnostic support and training initiatives. Lack of connectivity therefore complicates basic efforts to utilize the services of the agricultural ERP systems. There is a multitude of factors that influence how many people are on- or offline within a particular country.

These include first and foremost the status and degree of infrastructure roll-out, the state of national development, the regulatory and enabling environment and corresponding policies, and demographic and socio-economic status according to the White paper report on broadband regulation and policy of Asia-pacific region (2016). In this regard, the Measuring the Information Society Report of 2016, highlights a strong link between Internet uptake, education and income across both the developed and developing world. Moreover, the geographic location is also a significant determinant of connectivity. A large proportion of the rural population, especially in the developing world, remains unconnected, (MIS Report, 2016). Data on rural and urban Internet use is patchy (MIS Report, 2016). Still for most countries it holds true that rural Internet use is almost always lower than urban Internet use. To this effect, the McKinsey Report “Offline and falling

behind: Barriers to Internet Adoption" (2014) finds that urbanization is a key driver of Internet penetration.

Since Agricultural value-chain enterprise solution run on a connected device like a smartphone or an electronic gadget which can access an internet connection it is vital to look at connectivity on a holistic perspective covering both internet and telecommunication network a media through which connection happens. ITU report (2016) and Mobile network coverage and evolving technologies report (2016) shows that while 84% of world population live within coverage of 3G and 53% live within coverage of 4G networks, and while 66% of world population live within a 100 Km reach of fibre transmission networks only 39% of total population have 3G or 4G connections and only 11% have fixed broadband subscriptions, Consequently, there is not only an infrastructure or access gap, but also an Internet usage gap as per the report. As regards affordability, 57% of world population currently cannot afford Internet connection, because the costs of end-user devices, services, access and ancillary costs (including usage and device taxes) are still too high for many people (The Mobile Economy, 2015).

The reasons why people are not connected differ across countries and regions. Research for the years 2013-2015 on the top barriers to internet connection access at home shows that while the top barrier in the developed world appears to be affordability, in the developing world it is first and foremost relevance (McKinsey Report, 2014). The regions that are still faced with most significant challenges in overcoming Internet connection barriers are Africa and Asia-Pacific. Africa still faces challenges in relation to all Internet connectivity barriers, including affordability and relevance, capability and infrastructure. Africa is the region with the highest rural population standing at 62%. It also shows the lowest levels of income and education as well as the highest Internet usability gender gap (A4AI Affordability Report 2015-2016).

In a regional perspective of connectivity, there have been significant improvements to Africa's Internet connectivity in recent years. There has been enormous investment in telecommunications infrastructure, especially in terms of intercontinental connectivity.

However, the investments have not always translated into a corresponding improvement in the connectivity access services experienced by users with regards to lower prices or better quality of service. In many countries the development of Internet access services or connectivity is still held back by constraints on key inputs, notably the terrestrial connectivity between the submarine cables, the Internet exchange points (IXPs), and the Internet service providers (ISPs) that deliver access to the end-users in Africa (Schumann,2013). According to Schumann (2013), the increase in the number and capacity of submarine cables used to connect Africa to other regions has helped to support the rising number and usage of IXPs in Africa (used for local exchange of traffic and access to content). Investment in new submarine cables to Africa in recent years has totaled over USD 3.8 billion, adding over 24Gbit/s of new capacity to the 13Gbit/sin place prior to 2011.Despite all this investments in connectivity ,Africa still lacks widespread internet connectivity.

The limited availability of terrestrial bandwidth, both domestic and cross-border, constrains the benefits of the available and new submarine cables. This gives rise to a vicious circle: monopoly power leads to high prices, and rationing of access and low internet speeds; few users can afford the service, meaning that economies of scale are not achieved and prices for internet connectivity remain high. Connectivity is clearly fundamental to connecting users to the wider Internet in Africa. While bottlenecks may exist across every part of the Internet access connectivity, this study will among other objectives focus on connectivity, because it remains a key aspect of functional agricultural ERPs in Africa, as for a successful ERP system to flourish, there must be good structures that support its operations and existence. The figure below highlights the population in Africa without the internet access.

Kenya has since grown in terms of internet connectivity and now rates among the most connected country in Africa and the globe, according to the National ICT Survey report (2010) more than 31,000,000 Kenyans have access to the internet compared to its estimated population of 45,000,000 people but this is still not enough to guarantee the successful adoption of agricultural ERPs by farmers since connectivity is also faced by other

challenges such as unstable or unreliable internet connection. The process by which Africa embraced technology was accelerated when conditions for fair competition were created while at the same time technology allowed for connection of thousands of people at lower costs (CIPESA, 2005). Probably these are some of the factors have made internet/network connectivity in Africa relatively more successful but still leaves room for more research on how reliable the connectivity is able to supplement in technology systems such as agricultural ERPs especially in rural Africa. The phenomenal mobile telephony and internet take-up in Africa has surprised even the mobile phone service providers (Kinoti, 2006). Despite the numerous achievements that have been made under internet connectivity, Kenya's internet connectivity still faces challenges in the coverage and infrastructural challenges and it is for this reason connectivity will be among the areas of the study research for the effective adoption of agricultural ERP systems in Kenya.

2.4 The End-User Training and Adoption of Value-Chain Enterprise Solutions in Agricultural Production

End user training was another variable for study of this research as successful use of any agricultural ERP system is based on how well the intended users are able to use the system. Early and intensive end-user training (EUT) is usually advocated as a necessary part of the adoption of any agricultural ERP system. EUT is often described as "the teaching of skills to effectively use computer applications to end-users" (Gupta et al., 2010). Several studies have already shown that a lack of EUT is a major reason for a lack of IS/IT success, and that EUT is an important key factor in the successful adoption and user acceptance of IS/IT (cf., Gallivan et al., 2005; Garcia-Sánchez and Pérez-Bernal, 2007; Igbaria et al., 1995; Sweeney et al., 2005).

End user training, education and user involvement are critical success factors in the adoption of an ERP system because they are expensive, time consuming and require an accurate human resource management (Noudoostbeni et al., 2010; Aristomenis, 2006; Tsai et al., 2008; Wu et al., 2006; Smit, 2001). Information System researchers are placing a lot of interest in the ERP systems adoption topic (Al-Mashari, 2002; Verville and Halingten, 2003; Ifinedo et al., 2010). Shanks and Parr defined ERP adoption as "the process of

developing the initial business case and planning the project, configuring and implementing the packaged software, and subsequent improvements to business processes". Many adopting organizations have come to realize that the deployment of such systems were not as effective as expected (Wang et al., 2008). The main reason is that an ERP system adoption is a complex process, and it is considerably different from any traditional information system adoption (Chang, 2004). To avoid costly software adoption failures, much effort has been expanded to identify the key factors necessary for successful ERP adoption (Somers et al., 2001; Bhatti, 2005; Metaxiotis et al., 2005; Kalbasi, 2007; Adam et al., 2008).

There are several identified training methods that can be used in an ERP adoption to support the training activity (Paulsen, 2002; Zornada, 2005; Dorobăţ, 2010): classroom instruction, print-based material, e-learning (asynchronous), conference calls, e-mail, in person mentoring tutoring, online assessment and testing, online references, e-learning (synchronous), simulations, portals, video broadcasts, learning management systems (LMS), learning content management systems (LCMS), knowledge management systems (KMS), instant messaging, online mentoring tutoring, electronic performance support systems (EPSS), games, communities of practice, wiki, virtual laboratories, chat rooms, mobile learning, blogs, podcasts. Effective training is usually analyzed from 5 different perspectives: retention, flexibility, availability, investment, expandability (Dorobăţ, 2010).

Traditional training methods is less flexible (reduced availability) and significantly more costly in comparison with the newest computer based training methods. Regarding the trends in using the above mentioned training methods for corporative training Karrer stated that traditional training methods like classroom instruction or with print-based materials are still widely used compared with the computer based training methods (Karrer, 2008). A process of constant user engagement with end-users allows solution developers to address and respond to a dynamic user environment, technology and training needs.

The delivery of collaborated developed programs, informed by continual feedback from the end-user, and a blended delivery using the most appropriate formats ensures end users

are well catered for the solution which has been developed for them. This could be a seminar, workshop, on-line, interactive video, or hands-on practice based. A structured chain of user training is usually developed starting by design of the user requirements, followed by development which is the creation of content, then delivery which is usually choosing the appropriate medium of the training delivery and lastly constant renewal after getting feedback from the users after the whole process as outlined in the diagram below. End user training is there one of the vital factors to be considered for study by the researcher regarding factors that influence successful adoption of agricultural ERPs as lack of end user training makes the whole operability of the system an impossibility.

2.5 The Cost of Ownership and Adoption of Value-Chain Enterprise Solutions in Agricultural Production

Kathryn (2004) describes 'Total cost of ownership' as all the costs associated with the use of computer hardware and software including the administrative costs, license costs, hardware and software updates, training and development, maintenance, technical support and any other associated costs. Total cost of ownership analyses serve as planning tools. In our research study we will look at the overall costs that are incurred in implementing agricultural ERP systems, the costs may vary from gadgets that host the application to the actual cost of installing and using the agricultural ERP system. Just like any ICT software users are usually submitted to the direct and indirect cost e.g. buying the hardware like a mobile phone, tablet or computer , software application to be download, service charge fee whenever one accesses the software system.

Adoption of agricultural value-chain enterprise solution is recognized as an innovation in agricultural production processes, research on agricultural value-chain enterprise solution adoption is still very scarce. In some countries where such research has been done it focused mainly on farming soft wares for specific agricultural production process. It was found that adoption of agricultural value-chain enterprise solution has been strongly associated with the education level of the farmer and farm size (Warren et al., 2000).

Currently local agricultural enterprises are facing ever-growing international price and quality competition from food importers. Regardless they have to adhere to demanding social and environmental requirements within their traditional and new technologies. It is commonly accepted that enterprises can ensure their long-term survival and their acceptance by society only if they are able to create value for the consumer and the wider community of stakeholders. Knowledge and innovation processes are the very essence of creating value and growth in turbulent agricultural markets. In this context agricultural value-chain enterprise solution adoption can be considered as an important tool for value creation in the agricultural sector hence it is imperative to consider the costs involved in this innovation by farmers and how it affects their overall perspective on embracing technology. Most small-enterprises including first time agricultural value-chain enterprise solution adopters face numerous challenges to the acquisition and use of technology in agricultural production (Poole, 2006). Challenges of agricultural value-chain enterprise solution acquisition are common among small-enterprise in both the developed and developing countries, but developing countries are largely faced with more challenges due to costs associated with owning the agricultural value-chain enterprise solution. The most frequently cited challenges are poor telecommunications infrastructure, lack of skilled or limited training personnel, ineffective integration of technology into business processes, high costs of hardware equipment, and government regulations for e-commerce (Tan, et al., 2010).

The cost of adoption is an important factor in the adoption and utilization of any technology systems (Ernst and Young, 2001). Generally, the higher the costs of adoption of the innovation, the slower the pace of innovation and expansion is likely to be difficult. The cost factor was studied by various Information System (IS) researchers (Seyal and Rahim, 2006; Premkumar et al., 1997; Drury and Farhoomad, 1996; Cox and Ghoneim, 1996) and found direct and significant relationship between cost and adoption of technology. The lower the cost of adoption the higher the new innovation such as the agricultural ERP will be adopted by the company/individuals and vice versa.

Perceived cost of ownership is also another aspect of cost. The reason perceived cost of ownership is included in this literature is because it plays an important role for individuals in determining adoption of agricultural value-chain enterprise solution in their daily usage. Most individuals will less likely adopt a technology system when its initial set-up cost is high (Dixon et al, 2002). Poon & Swatman (1996) stated that small businesses often have difficulty in obtaining financial resources. Any new technology like agricultural value-chain enterprise solution may be considered too expensive to many small and medium enterprises because of their lack of financial resources (Poon and Swatman, 1999). Small and medium enterprises face specific problems in the formulation of their innovation strategies due to their limited resources and range of technological competencies. According to Duncombe and Heeks (2001), survey on small and medium enterprises found that 90 % of the SMEs lack of finance and skills are the main constraints for organization to utilize technology adoption such as the agricultural value-chain enterprise solution. Some of them cannot afford to buy a computer or make efficient use of it in the short or even medium period of time.

2.6 Demographic Characteristics of ICT users and Adoption of Value-Chain Enterprise Solutions in Agricultural Production

Information and communications technology (ICT) has become an unavoidable issue of our everyday lives over the past two decades. Increasing use of innovative technological systems such as the agricultural ERPs in our everyday needs and farming environment has changed the farmers' classical role from traditional farming practices environment to a customer/client centered environment. However, farmers are still having difficulty implementing the new concept of agricultural value-chain enterprise solution because of the personality factor. Recently, there has been a growing interest in using personality as an explanatory tool in literature to help us understand the usage of technology (Devito Da Cunha & Greathead, 2007; Oreg & Nov, 2008; Pratt & Chudoba, 2006). Personality traits predispose technology users to behave in certain ways under different circumstances or situations (Thatcher & Perrewé, 2002).

The psychology literature used personality as a predictor of human beliefs and behavior. There is substantial evidence for the role of personality traits as predictors of beliefs and behavior across a variety of contexts (Mischel 2004; Pulford & Sohal 2006). According to Schillewaert et al. (2000), personal innovativeness is a characteristic that greatly affects consumer acceptance of technology. Personal innovativeness or general innovativeness, is defined as the "the degree to which an individual is relatively early in adopting an innovation than other members of his (social) system". That is an assumption or belief that is not necessarily conscious, but that impacts how someone behaves, makes decisions and forms preferences. It can be thought of as a kind of personal paradigm (Stauffer, 2015b), while personal innovativeness in IT is defined as the willingness of an individual to try out any new information technology (Agarwal & Prasad 1998). High innovativeness level in a person reflects a great deal of readiness in accepting a new technology. Level of innovativeness can be influenced by demographical factors too (and thus make this field as one of the areas of our study in determining the factors that influence the adoption of agricultural value-chain enterprise solution among farmers in Kenya through a case of Makueni county. Hence it is imperative to look at demographic characteristics of ICT users as one way of establishing how well a given technology system such as the agricultural value-chain enterprise solution will be accepted by a community or people.

Information communication and technology (ICT) acceptance has been the subject of many research studies over the past decades. Since the early 1990s, several theories have emerged offering potentially new insights into the relationship between actual ICT acceptance and use, at both individual and organizational levels. Of these theories, the Technology Acceptance Model (TAM) has received more attention, perhaps because of its parsimony and the wealth of recent empirical support for them (Plouffe et al., 2001; Grandon and Pearson, 2004; Shih, 2004). However, the theoretical validity and empirical applicability of the TAM still need to be extended to incorporate different technologies.

This is especially true when studying the acceptance of agricultural ERP systems, as their technology settings and operational environments differ drastically compared to

conventional IT and conventional business environments . The TAM model, has been used to investigate the effect of demographic differences of agro value-chain solution adopters such as the agricultural ERP system. This model focuses on the investigation of the impact of gender, age, and IT competence on agricultural ERP system adoption, basing on the theoretical framework of TAM. Gender has been identified to be a strong predictor of attitudes and behavior in electronic information seeking and a major demographic factor that strongly influences information behavior (Ray and Chi, 2003). Although a comprehensive literature review is unlikely to ascertain the effects of all demographic characteristics on the use and adoption of agricultural value-chain enterprise solution, it is important to note a few key studies that have identified important differences in certain key primary demographic characteristics. Research on computer competence in general also revealed that males on average have better computer self-efficacy than females. The issues of gender and other demographic characteristic are very relevant in this age when considering individuals' proficiency in computer usage. The research on gender and computing has often, although it has not been conclusive, reported that males have more experience and use of computer than females (Balka & Smith, 2000). In a study of gender difference and e-mail use, (Gefen and Straub ,1997) suggested that gender differences would only cause a difference in the perceptions of, but not the actual use of, technology. For example, they found that females perceived the social value of e-mail to be higher than males did.

Females perceived e-mail to be more useful, but more difficult to use, than males did. (Venkatesh and Morris, 2000) pushed the boundaries of gender research further through their investigation of the short-term and long-term structural relationships between gender, social influence, and the role that they play in technology acceptance and usage. In their research, it was found that male technology decisions were more influenced by their perception of usefulness, while female decisions were strongly influenced by subjective norms and the perception of ease of usage, although the issue of subjective norms diminished over time.

Current research on gender for TAM suggests that females and males look differently at technology use, meaning they use and apply technology differently (Ford et al., 1996; Venkatesh and Davis, 2000; Adamson and Shine, 2003; Faja and Trimi, 2008). (Igbaria and Zinatelli, 1998), for example, has investigated computer usage patterns in small firms/organizations and found that males more frequently use spreadsheets, data management packages, programming languages, and graphic packages, whereas their female counterparts use application packages more frequently. (Teo and Lim, 1996) also detected gender differences in the perception of ease of use, job fit, image, and voluntariness, but not in factors related to usefulness, trial ability, and complexity. More recently, (Cyr and Bonanni ,2005) have investigated the differences between genders regarding attitudes towards transaction security, preferred website design elements, website trust, website satisfaction and website loyalty. Their results indicated that the concern of e-commerce business transaction security of e-business did not differ between men and women. However, there are significant differences in perceptions of website design and website satisfaction between the genders, hence gender becomes a vital factor for study since it will assist the researcher analyze the different demographic factors that can influence agricultural value-chain enterprise solution adoption . According to ITU report (2017), it reveals that women, when compared to men with the same education and income levels, are 50% less likely to be use the internet.

This has resulted in there being 250 million fewer women connected to the internet than men worldwide. Education level and age are key drivers of women's acceptance to technology. More work is needed to address women's usage of technology. Between 2013 and 2016, the gender gap in Internet and technology use had widened around the world, especially in Africa (from 20.7% to 23%) and Arab States (from 19% to 20%). Since available literature already shows that there is more reason to undertake research on the influence of gender on technology acceptance it becomes an area for study of this paper to research more on its role in agricultural value-chain enterprise solution adoption. Research study has shown that age is related to an individual's working style and attitude (Morris and Venkatesh, 2000; Adamson and Shine, 2003). Due to value differences in job selection, older workers are perceived to be more likely to focus on relationship building with their

co-workers and give less emphasis to adopt technology in their work. In contrast, younger workers will look to adopt technology for help in enhancing their work performance (Adamson and Shine, 2003). To younger workers, technology is perceived as a competitive tool that can offer not only automation, but also unprecedented ability to improve job efficiency and effectiveness.

However, this age-related supposition may be challenged by today's Internet development and usage. The recent rise in popularity of web-blogging and social media among youngsters demonstrates that teenagers are no longer using technology solely to enhance their job performance, but also to enrich their social activities and personal relationships. There is evidence that suggests that age does influence an individual's technology acceptance and use (Morris and Venkatesh, 2000; Ford et al., 2001; Spacey et al., 2004). Specifically, these studies have found that older people are less comfortable, less competent, and less in control when using technology. Older people also perceived technology to be more dehumanizing (Czaja and Sharit, 1998; Adamson and Shine, 2003). In general, younger people often adopt new technology earlier, and their experience using new technology will have an important effect on subsequent adoption of further new technology (Czaja and Sharit, 1998).

It has been found that age has some correlation with the average users' computer pattern and sources of assistance (Lee, 1986). Other scholars have however pointed out that age has an impact on applications used, user's level of sophistication, and the duration of their use and computer anxiety (Igbaria, Pavri, and Huff, 1989). Using the theory of planned behavior, Morris and Venkatesh (2000) investigated the behavior of young people and old workers when using a new software system. Their findings concluded that age does have a significant effect on technology use. For example, younger workers' decisions on use of technology were more influenced by their attitudes toward that technology, while older workers were more influenced by subjective norms and perceived behavior control. Because of these age differences regarding the use of technology, the authors argued that understanding specifically who the users of technology will be, can help an organization deliver effective support mechanisms for their workers.

Despite the general consensus of the effect of age on technology acceptance, several research in age-technology has produced some conflicting results. Rosen and Maguire (1990), for example, argued that not enough evidence has been accumulated to validate the assumption that younger people will have more positive attitudes and less anxiety toward technology use than older people. Bush (1995) also reported a similar study conclusion that age had no significant effect upon attitudes toward computers. Pope-Davis and Twing (1991) even found a significant positive relationship between age and attitudes toward computers, suggesting that older people hold a more favorable attitude towards computer use than younger people. Rosen and Weil (1995), in their age and entertainment technology use study research, also pointed out that teenagers use fewer complex computer functions (other than playing games) than adults. In addition, adults were found to have higher usage levels of personal computers, as they needed to, and were able to, use complex functions on their computers. It is against this backdrop of this literature on how age affects technology acceptance that guides the researcher to further.

IT competency is a set of IT-related explicit and tactic knowledge an individual possesses on a technological appliance or system (Bassellier, Reich, and Benbasat, 2001). IT competency has a significant effect on how a computer or system is perceived and used (Rosen and Weil, 1995). Generally, IT competence can be determined by the end-user's breadth and depth of knowledge of the technology hardware or platform, as well as their finesse in using it (Munro et al., 1997). However, some Information system researchers (such as Bassellier, Reich, and Benbasat, 2001) preferred to use explicit technology knowledge and tacit technology knowledge as measures of competence. Although the two constructs measure IT competence from two different perspectives, breadth and depth of technology knowledge are in fact almost similar to explicit technology knowledge, while finesse levels, defined as the creativeness and innovation when using a particular technology, are in fact a kind of tacit technology knowledge.

IT competency has also been investigated at the organizational level. IT competency relates to knowledge of IT and the extent to which a firm or an individual is able to effectively utilize IT for information management (Tippins and Sohi, 2003). According to Zhu and Kraemer (2005), the IT competence of a firm consists of the firm's technology infrastructure and IT human resources. Feeny and Willcocks (1998), however, summarize IT competency into nine different categories: IS/IT governance, business systems thinking, relationship building, design of the technical architecture, a working technology, informed buying, contract facilitation, contract monitoring and vendor development. This is as far as competency on both individual and an organization levels are concerned in adoption of technology. The increasing importance of information in daily usage of basic services has necessitated a need for a more tech-savvy population. For example, Cooper and Zmud (1990) suggested that IT diffusion and use require consideration of the IT competence and sophistication. Thong (1999) also confirmed that IT competence is a critical determinant of IS and electronic data interchange.

As far as education qualification is concerned, it is important, not only with respect to gaining the needed ICT skills, but also with respect to people's motivation to even use technological tools. It is generally emphasized that the level of education has the strongest influence on the use of technology as most of the people that use technology innovation systems such as agricultural value-chain enterprise solutions are mainly educated people. People with higher education levels are more likely to embrace application technology such as agricultural value-chain enterprise solutions because they may have more skills and chances to go online.

At the same time, the role of formal education in building farmers equipped with knowledge skills to use agricultural value-chain enterprise solutions is currently the subject of debate. Meso, Musa and Mbarika (2005) reported academic discipline as another demographic factor that determines the adoption and use of technology in agriculture. UNDP (2011) asserted that the level of education, and computer use experience as major determinants of technology use. Educational qualification was found to be the strongest predictor of technology use among the demographic variables ahead of

technology use experience. It therefore becomes imperative to study level of education as a factor to determine the factors that influence the adoption of agricultural ERPs among farmers since this ERP are technology systems.

2. 7 Theoretical Framework

This study is anchored on two theories; technology acceptance theory and theory of reasoned action. The two theories explain why social influence and perception affects how people adopt the use of technology.

2.7.1 Technology Acceptance Model (TAM)

One of the well-known models related to technology usage is the technology acceptance model (TAM), originally proposed by Davis in 1986. TAM has proven to be a theoretical model in helping to explain and predict user behavior of information technology (Legris, Ingham, & Collerette, 2003).TAM is considered an influential extension of another theory known as the theory of reasoned action (TRA), according to Ajzen and Fishbe in (1980). Davis (1989) and Davis, Bagozzi, and Warshaw (1989) proposed TAM to explain why a user accepts or rejects information technology by adapting the TRA. TAM provides a basis with which one traces how different external variables influence belief, attitude, and intention to use. Two cognitive beliefs are posited by TAM: perceived usefulness and the perceived ease of use.

According to TAM, one's actual use of a technology system is influenced directly or indirectly by the user's behavioral intentions, attitude, perceived usefulness of the system, and perceived ease of use of the information technology system. TAM also proposes that external factors affect intention and actual use through mediated effects on perceived usefulness and perceived ease of use. It is through TAM that we can link and explain the user behavior of the agricultural ERPs, the model links user behavior to two aspects that determine if a technology system will be accepted by the users or not.

The two cognitive beliefs advocated by TAM is related to how users of the agricultural value-chain enterprise solutions will behave once they interact with the system, first is the

perceived usefulness which when a user interacts with the agricultural value-chain enterprise solutions based on how useful they find the technology to be will determine the attitude of the user towards the system and also whether they will initiate a behavioral habit/intention to use the system, it is through the combination of both or one of the attributes that will determine the actual of the system , in this case the agricultural value-chain enterprise solutions . The above is also influenced by the perceived ease of use, which is the other cognitive belief. The perceived ease of use will directly or indirectly influence the attitude of users towards the agricultural value-chain enterprise solutions usage, all the two beliefs are considered to be external factors affecting intention and actual use of an information system. Figure 1 depicts the original TAM (Davis, 1989).

TAM was first introduced by Davis in 1986 and revolved around the concept of technology acceptance. As depicted in Figure 1, TAM posits that acceptance of a new IS can be predicted based on users' behavioral intention (BI), attitude towards use (A), and two other internal beliefs: perceived usefulness (U) and perceived ease of use (E). Davis (1989) defined perceived usefulness as the prospective user's subjective probability that using a specific application system will increase his or her job performance within an organizational context and perceived ease of use as the degree to which the prospective user expects the target system to be free of effort . According to TAM, behavioral intention (BI) defines the actual use of a given IT system and therefore determines technology acceptance. Attitude towards use (A) and perceived usefulness (U) jointly influence BI (A). BI is also indirectly affected by perceived ease of use (E). A is directly affected by both U and E, while U is directly influenced by E. Further, TAM theorizes that perceived usefulness and perceived ease of use are affected by external variables. Thus, U and E mediate the effect of external variables on user's attitude and behavioral intention, and therefore the actual system use.

Several studies have examined TAM as a model to explain how people adopt and use e-learning. This theory is applicable in this study as it will outline how different external factors affect the intention and actual use of an IS system through perceived usefulness and ease of use which shapes the behavior and attitude of the actual system usage. In this case,

adoption of the value-chain solution is tied to how the population perceives the usefulness and ease of use of the system to their daily requirements and how they will reap comparative advantage by using it.

2.7.2 Theory of Reasoned Action

Theory of Reasoned Action is a series of related concepts and hypotheses postulated by social psychologists to understand and to predict human behavior (McKemey et al., 2000). TRA has developed from the long standing collaborative research conducted by renowned psychologists Fishbein and Ajzen. This resulted from attitude research using the Expectancy Value Models (Fishbein and M., 1968). They did this formulation of TRA after trying to estimate the discrepancy that existed between attitude and behavior. From the onset of TRA in behavioral research, it has been applied to study a wide variety of situations and is now regarded as one of the most influential theories about volitional human behavior (Trafimow, et al., 2002).

The Theory of Reasoned Action (Ajzen & Fishbein) is a widely accepted and tested behavioral model theory that examines the determinants of consciously intended behaviors (Davis, 1989). The ultimate goal of the TRA is to predict and understand a person/ individual‘s behavior. These predictions and understandings have been applied in different fields in order to intervene and promote positive behaviors. The TRA uses three determinants of human behavior: behavioral intentions, and its antecedents, attitudes and subjective norms. The TRA views a person‘s intention to perform (or not perform) a given behavior as the immediate determinant of the action. Ajzen and Fishbein define behavioral intention as a measure of the likelihood a person will engage in a given behavior or action

According to the TRA model, a person‘s behavioral intention is a function of two determinants, one personal in nature and the other reflecting social influence (Ajzen & Fishbein, 1977). The personal factor is the individual‘s positive or negative evaluation of performing the behavior or attitude toward the behavior. The social determinant of intention is the individual‘s perception of the social pressures put on

him to perform or not perform the behavior in question while Ajzen (1991) refers to attitude as the degree to which a person has a favorable or unfavorable evaluation of the behavior in question.

Given the importance of analyzing IS system adoption and intentions, the study will incorporate Ajzen and Fishbein's (1977) theory of reasoned action (TRA) as a theoretical framework since the theory explicitly accounts for behavioral intentions of users in adopting IS systems. Through TRA we can examine the user behavior of the agricultural value chain ERPs, the model links user behavior to two aspects that determine a behavioral intention by users to use the system. The two cognitive beliefs advocated by TRA is related to how users of the agricultural ERPs will behave once they interact with the system, first is the attitude towards act or behavior which when a user interacts with the agricultural value-chain enterprise solutions based on their attitude with the interaction of the system will subconsciously determine if they will create a behavioral intention to use the technology system, attitude creates either a positive or negative evaluation on whether they one will adopt the behavioral intention to use the system, in this case the agricultural value chain enterprise solution.

Subjective norm is the other cognitive belief. The subjective norm will directly or indirectly influence the behavioral intention of users towards the agricultural value chain enterprise solution usage since based on how a user evaluates his interaction with the agricultural value-chain enterprise solution, it will shape his future habits on whether to adopt it or not, all the two beliefs are considered to measure the likelihood a person will engage in a given behavior or action in this case the agricultural value-chain enterprise solution adoption.

2.8 Conceptual Framework

The interrelationships in study variables is as depicted in the framework in Figure 2

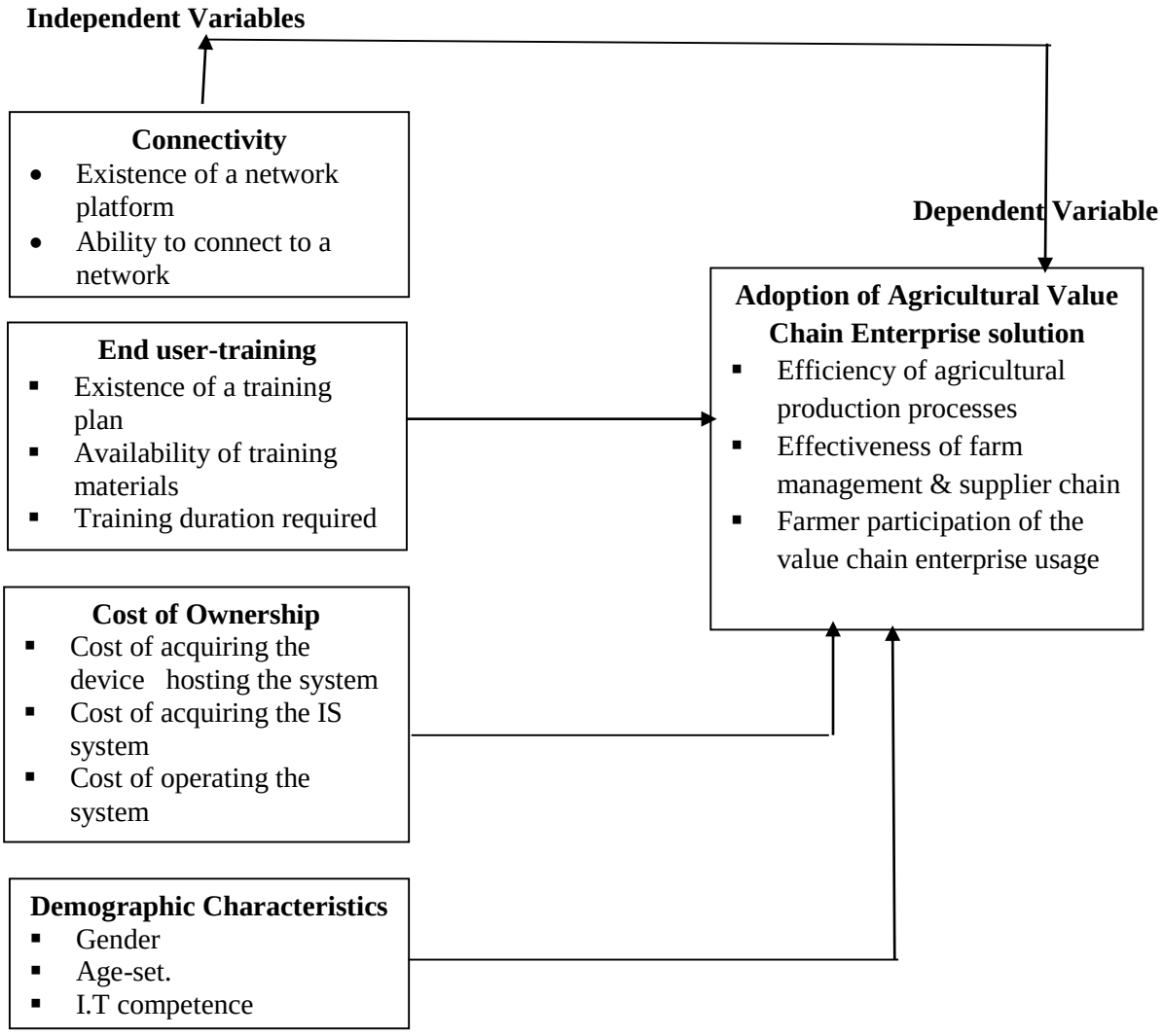

Figure 1: Conceptual Framework

Conceptual Framework on Factors Influencing the Adoption of Agricultural Value Chain Enterprise Solutions

2.9 Knowledge Gap

No study has been carried on the factors influencing the adoption of agricultural value-chain enterprise solutions in Kenya. This study was seeking to fill this research gap by investigating factors influencing the adoption of agricultural value-chain enterprise solutions in Makueni County, Kenya. The disconnection between technology and farmer linkages has led to the research studies being investigated not being in accordance with the priority needs of agricultural stakeholders. The introduction of value chain approach is an effort to align the priorities of farming research activities with technology demands. The agricultural value-chain enterprise solutions platform catalyzes the dissemination effort, in addition to addressing traditional differences that have existed preventing effective collaboration between research and extension. Neither research nor extension can fulfill their mandates effectively without the other. Both strategic and adaptive research require closer link with both extension staff and the farming community.

The weaknesses in the links between research, extension and farmer linkages has created isolation in technology development and knowledge transfer. The agricultural value-chain enterprise solution platform provides a linkage with the resultant effect seen in influencing formulation of the research agenda based on problem identification and the need to evolve technologies suitable for the prevailing socio-economic environment. Extension requires a constant flow of information on new and improved technologies and practices creating a dual communication.

The literature review confirmed that a lot has been done on technology innovation in enhancing farming activities and the extent to which connectivity, end user-training, cost of ownership and demographic characteristics influence the adoption of agricultural value-chain enterprise solutions in agriculture. It is evident that investing in agricultural value-chain enterprise solutions for farming improves productivity and livelihood opportunities. The studies have not adequately looked at why agricultural value-chain enterprise solutions projects are not achieving their intended objectives and as result the intended impact is not realized i.e. efficiency in the agricultural value-chain. In addition most research studies conducted on technology adoption in the agro-value chain sectors only focuses on the effect

of one or two attributes and not the entire combination of attributes needed to gauge how they affect the adoption and adoption of an agricultural value-chain enterprise solution in the agro-value chain production line.

This is research gap that this study was seeking to fill, it aims to cover the important attributes that affect how farmers perceive and consider before employing an agricultural value-chain enterprise solution in their agricultural production within the Kenyan context. This study therefore sought to seek the factors influencing the adoption of agricultural value-chain enterprise solution in agricultural production among framers in Makueni County.

2.10 Summary of Literature Reviewed

This section summarizes the major findings of the literature review in general terms. Among the themes discussed includes: connectivity of users to a system or platform where they can use the IS system, user-training, total cost of ownership and lastly the demographic factors which all determine how a particular group will adopt or reject a given IS system. In order to achieve the SDGs, Kenya vision 2030 and Africa vision 2063 we need to incorporate innovative technology solutions in agro-value chain projects. Various researchers are generally in agreement that agricultural ERPs in agro-value chain generally improves the quality, effectiveness, efficiency and accountability of agro-production. From the literature review it is quite evident that connectivity, user-training, cost of ownership and demographic characteristics are essential to adoption and adoption of agricultural value-chain enterprise solutions.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1. Introduction

The chapter contains the components of research methodology that were used in the research study, which include the research design, target population, sample size, sampling procedure, data collection method, data collection procedure and data analysis method. The chapter also further includes the validity and reliability check on the research instruments as well as ethical issue in the study. Data analysis involves categorization and tabulation into different forms for ease of interpretation. The study used questionnaires for data collection method which was able to collect appropriate information as required by the study.

3.2. Research Design

Descriptive survey study design was adopted for this study. A descriptive research design determines and reports the way things are and uses a pre-planned design for analysis (Mugenda and Mugenda, 2003). Cochran (2007) observes that a descriptive research design is used when data is collected to describe persons, organizations, settings, or phenomena. The design also has enough provision for protection of bias and it maximizes reliability of data (Kothari, 2008).This design was used because the researcher collected the data through interview schedule and questionnaire hence the design was appropriate, also the design was appropriate because it was used to describe the characteristics of a population which in this case is the farmers in Makueni County. The design was therefore chosen as it was used to study specific variables whereby in this case relates to determinants that influence the adoption of agricultural value-chain enterprise solutions among farmers without the researcher manipulating the study variables.

3.3 Target population

Polit and Hungler (1999:37) refer to the population as an aggregate or totality of all the objects, subjects or members that conform to a set of specifications, Mugenda & Mugenda (2003) defines a population as an entire group of individuals, events or objects having common observable characteristics. The study was conducted in the vast Makueni County;

the county is comprised of six constituencies or sub-counties namely Kilome, Mbooni, Kaiti, Makueni, Kibwezi West and Kibwezi East. The target population for this study was the farmers using the EDENSYS ERP who equate to 400 individuals (EDENSYS, 2017) in Makueni County.

3.4 Sample Size and Sampling Procedure

According to Mugenda and Mugenda (2003) a sample is a smaller group derived from the accessible population. It is the few items selected for the study from the target population (Orodho, 2010). Gay as cited in Mugenda and Mugenda (2003) argue that for descriptive studies, ten percent of the accessible population is enough. The sample size of the farmers using EDENSYS system was picked using the model table of Morgan and Krejcie (1970). Basing the determination of sample size with Morgan and Krejcie (1970) model, the sample size of farmers using EDENSYS system in the county is 196. The study used multi stage sampling technique. In this technique the sample frame was divided into clusters based on administrative units such as sub-county, divisions and then locations. The farmers in a given location were serialized, and then a sample farmer was picked from every third count repeatedly until all farmers in that location were sampled. This was done only in the administrative units where farmers are using the EDENSYS ERP system. This procedure was repeated in all locations to arrive at the sample size. The technique though time consuming is accurate, cost effective and more reliable.

3.5 Data Collection Instruments

Any device (such as a pencil and paper test, a questionnaire, or a rating scale) a researcher uses to collect data is referred to as an "instrument". The process of data collection is called "Instrumentation". This process involves the selection of the instruments and also setting the conditions under which the instruments will be administered. The study collected data from the farmers using EDENSYS ERP system from each sub-county using a structured questionnaire. This instrument is preferred by the researcher since it is effective in generating the required response. The closed ended questions are easier to administer as each item is followed by an alternative answers and it is also economical to use in terms of time and money. The research adopted the use of likert scales to order the questions in such

a way that they indicate the absence or presence of the characteristics being investigated, (Mugenda & Mugenda, 2003). The questionnaires are appropriate in this study as they permit a greater depth of response especially as the study evaluates perception which is attitudinal in nature and thus this type of questions allowed the respondents to give their feelings, background, hidden motivation, interests and decisions (Mugenda and Mugenda, 2003).

3.5.1 Pilot Testing

The main objective of conducting a pilot test is to detect weakness in the design and instrumentation and also to provide alternative data for selection of a probability sample (Kothari, 2008). According to Mugenda and Mugenda (2003), the purpose of pre-testing a questionnaire is to ensure that items in the questionnaire bear the same meaning to all respondents and to assess the average time that is required to administer the instrument. The Pilot testing of the research instruments was conducted in Makueni sub-county. According to Connelly (2008), suggests that a pilot study sample should be 10% of the sample projected for the larger parent study, in this case 20 questionnaires were administered to the pilot survey respondents; who were then chosen randomly from the provided target population. After seven days the same participants were again requested to respond to the same questionnaires but without prior notification in order to ascertain any variation in responses of the first and the second test. Such research process is important because it assisted in identifying vague and unclear questions. The process also provides an opportunity to participants to contribute their comments and suggestions in order to improve the efficiency of the instrument further.

3.5.2 Validity of Research Instrument

According to Mugenda and Mugenda (1999), validity is the accuracy and meaningfulness of inferences which are based on the research results. They argue that validity has to do with how accurately the data obtained in the study represents the variables of the study. Mugenda and Mugenda (2003) further defines accuracy or the meaningfulness is the degree to which results obtained from analysis of data represented in the phenomena of study. The Validity measure depends on how accurate the researcher collects the data

for the study. Validity refers to whether the research truly measures that which it was intended to measure or how truthful the research results are (Joppe, 2000). It is validity that ensures accuracy of information obtained by the researcher. Validity of instruments is critical in all forms of researches and an acceptable level is largely dependent on logical reasoning, experience and professionalism of the researcher. Content validity depends on the experts in the field. It is for this reason the researcher formulated a questionnaire that was tailored to obtain relevant and accurate response from the target population. The research instrument was then piloted with 20 respondents randomly selected from the target population to establish content validity, a procedure known as pre-testing. On the basis of their response, changes were made to the questionnaire to clarify wordings and increase understanding.

3.5.3 Reliability of Research Instrument

Reliability is defined as the degree to which a particular measuring procedure gives similar results over a number of repeated trials (Orodho, 2010). Reliability is synonymous to consistency thus reliability is a measure of how consistent the results from a research study are. Phelan (2006) further defines reliability as the degree to which an assessment tool produces consistent and stable results. To ascertain the reliability of the research instrument, the researcher employed a test-retest method on a selected sample with the same characteristic as the population under study to estimate the degree to which the same results could be obtained with a repeated measure of accuracy of the same concept during the pilot survey. It involved applying the same "test" to the same observations after a period of time (In this case one week) and then comparing the results of the different measurements.

3.6 Data Collection Procedures

Data was collected from the identified respondents using questionnaires that were distributed by the researcher. For those who are able to read, they were issued with the questionnaire which the researcher later collected once they completed filling it. For those who could not read, the researcher had to physically ask the respondents the questions in the questionnaire in the order in which they are listed and record the replies in their

questionnaire. To avoid interviewer bias, the researcher treated the respondents as consultants giving them the benefit of doubt.

Questionnaire enables the researcher to focus on areas of importance and which address the research directly (Leedy, et al., 2001). Structured questions reduce data collection time. The questionnaires are preferred because of their ability to reach a large number of respondents within a short time and elicit personal ideas from the respondents due to openness of some questions. Also, questionnaires compared with other data collection techniques are less costly to administer as supervision or follow up of respondents will not be required. Pre-testing of questionnaires in the field will be used as a means of improving the quality of questions before the main study (Jonathan, 2003).

3.7 Data Analysis Techniques

Data analysis is defined as the examination of what has been collected in a survey or experiment and making deductions and inferences from this data through organizing the data, breaking it into manageable units, synthesizing it as well as searching for patterns, (Orodho, 2002). Data was analyzed using both qualitative and quantitative techniques of analysis. For quantitative data entry and analysis, the statistical package for social sciences (SPSS) was used. The researcher analyzed the quantitative data using descriptive statistics by applying the statistical Package for Social Sciences (SPSS) and presented through percentages, means, standard deviations and frequencies. The data was then presented in tables that indicate percentages of a given attribute. These percentages was then analyzed systematically to provide trends patterns and relationships between various independent and dependent variables from which conclusions were drawn. For qualitative data, systematic analysis of data given was done to arrive at meaningful and useful conclusion. Conceptual content analysis was used for data that is qualitative in nature or aspect of the data collected from the open ended questions.

3.8 Ethical issues

Ethics is an integral part in any research; strict ethical consciousness was therefore adhered to. This included confidentiality and privacy of respondents which was protected by

keeping information provided confidential. The respondents were informed that whatever they would say would only be used for research study purpose. Research was carried without bias and the researcher also ensured confidentiality of the information given by the respondents.

3.9 Operational Definition of Variables

Operationalization of variables is as shown on Table 3.1

Table 3.1 Operationalization of Variables

Research objective	Type of variable	Indicators	Measurement scale	Type of analysis
To determine how the different demographic characteristics influence the adoption of agricultural value-chain enterprise solutions in the agricultural production chain.	Demographic characteristics (independent)	-How gender affects usage. -How each age set perceives the IS system. -Effects of education level and I.T competence on usage of the IS.	Ordinal	Descriptive statistics Inferential statistics
To establish how connectivity influence the level of adoption of agricultural value-chain enterprise solutions in agricultural production?	Connectivity (independent)	-Existence of a network platform -Ability to connect to functional network	Ordinal	Descriptive statistics Inferential statistics

To access how end user-training influences the adoption of the agricultural value-chain enterprise solutions in agricultural production.	End user-training (independent)	-Existence of an end user-training plan -Availability of training materials -Training duration required	Ordinal	Descriptive statistics Inferential statistics
To establish how costs of ownership influences the adoption of the agricultural value-chain enterprise solutions in agricultural production.	Cost of ownership (independent)	-Cost of acquiring the device hosting the system. -Cost of acquiring the IS system. -Cost of operating the system.	Ordinal	Descriptive statistics Inferential statistics

CHAPTER FOUR
DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Introduction

The main focus of this study is to analyse the factors influencing the adoption of agricultural value chain enterprise solutions in agricultural production projects. This chapter presents findings of data analysed and interpreted in line with the study objectives. The first part outlines the questionnaires return rate by the respondents. It presents the descriptive data for the part of the population used in the study. The next part presents information on demographic data of respondents which is divided in three categories namely; gender, age groups and education level and I.T competence of users.

4.2 Questionnaire Response Rate

The study used questionnaires as tools for data collection. A total of 196 questionnaires were sent out and 146 were returned translating to 74.4% return rate. The response rate of between seventy to eighty per cent is considered good for a research study (Kothari, 2005).

4.3 Demographic Characteristics of the Respondents

As part of demographic information, the study sought to establish the background information of respondents. This included gender, age group, education level and IT competence.

4.3.1 Distribution of respondents by gender

The information regarding the gender distribution was captured in the Table 4.1.

Table 4.1: Respondents by Gender

Gender	Frequency	Percentage
Male	56	38.36%
Female	90	61.64%
Total	**146**	**100**

Table 4.1 shows that 61.64 percent of the respondents were females and 38.36 percent were males. Majority of the respondents were female indicating more women than men are engaged in agricultural production in the region. This is also in line with the gender distribution of the total population of the county where there are more females than men in the general population.

4.3.2 Distribution of Respondents by Age Group

From the table below, majority of the respondents were aged between 26 years to 35 years accounting for 36.99 percent of the sample. 10.27 percent of the respondents were 56 years and above, forming the minority in the sample. From the table we can deduce that farmers in their prime age of between 26 years to 45 years were actively engaged with the agricultural production projects accounting to a total of 54.79 percent, this is slightly more than half of the total number of respondents which was 80 respondents.

Table 4.2: Distribution of Respondents by Age Groups

AGE BRACKET IN YEARS	NUMBER OF RESPONDENTS	PERCENTAGE
Below 25	34	23.29 %
26 – 35	54	36.99 %
36 – 45	26	17.81 %
46 – 55	17	11.64 %
Above 56	15	10.27 %
Total	**146**	**100**

4.3.3 Distribution of Respondents by Highest Level of Education

The study sought to find out the highest academic qualification of the respondents. The findings were recorded in the table 4.3.

Table 4.3: Distribution of Respondents by Highest level of Education

Level of education	No. of Respondents	Percentage
Primary level[K.C.P.E]	38	26.03%
O-level [K.C.S.E]	56	38.36%
A-level	3	2.05%
Certificates	23	15.75%
Diploma	15	10.27%
Degree	10	6.85%
Masters	1	0.68%
P.H.D	0	0%
Any other		0%
Total	**146**	**100**

From the findings, the researcher discovered that the literacy level of the respondents was high. 73.97 per cent of the respondents had attained O-level and above academic qualifications. From the table 0.68 per cent had attained Master's degree as their highest level of education, majority of the respondents had attained O-levels as their highest academic qualification accounting for 38.36% of the total respondents. None of the respondents' had acquired PhD or had any other qualification.

4.3.4 Distribution of Respondents by I.T Competence

The study sought to find out the Information technology competence of the respondents. The findings were presented in the Table 4.4.

Table 4.4: IT Competence of respondents

I.T Competence	No. of respondents	Percentages
Novice	98	67.12%
Intermediary	27	18.49%
Advanced	18	12.33%
Expert	3	2.05%
Total	**146**	**100**

Table 4.4 indicates that majority of the respondents were novice users of information technology systems accounting to 67.12 per cent of the total respondents followed by intermediary users t 18.49% translating to 27 participants. A total of 3 respondents were at expert level in using IT systems translating to 2.05 per cent of the total respondents which was the lowest in this particular area followed by advanced users accounting to 12.33% equivalent to 18 participants.

4.4 Connectivity

The study identified connectivity as one of the factors that influence the adoption of the agricultural value chain ERPs in agricultural production. Subsequently, the study assessed the extent to which connectivity influences the agricultural ERP adoption by establishing the respondents' level of agreement with the following statements. The responses were rated on a five point likert scale indication to what extent respondents agree to the statements The values were assigned as follows: 1- strongly disagree, 2-disagree,3-neutral,4-agree and 5-strongly agree. Mean scores and standard deviation were computed for each statement and summarized in Table 4.5:

Table 4.5: Connectivity

Connectivity	Mean	Standard Deviation
Network coverage is sufficient and covers most areas	3.79	0.846
Internet speeds can comfortably satisfy my needs	4.09	0.796
Internet connection is steady and never fluctuates	3.08	0.890
The internet data never disconnects while in use	2.19	0.636
There are available alternative service providers for internet connection	3.27	0.965
It takes a shorter time to access my internet network	3.70	0.755
The availability of different reliable internet connection vendors influenced my decision to use the agricultural ERP	3.18	0.910
I considered connectivity in my decision to implement the agricultural ERP	4.61	0.490

Generally, respondents were observed to agree with most of the statements on connectivity and its influence on adoption of the agricultural value chain enterprise solution. However, internet speeds and network coverage to enhance connectivity were rated as the highest connectivity factors that influence users to implement the agricultural value chain enterprise with mean scores of 4.09 and 3.79 respectively. Internet network access time was rated third with a mean of 3.70 while alternate internet service providers was found to be of average adoption factor with a mean of 3.27, this was a result of the sample region not having uniform internet connection thereby some areas had more internet service providers as a result of available infrastructure and others not having the same thereby lacking alternate options for service provision. Reliability of internet connection had a low rank average with a mean of 3.08 while data downtime disconnection ranked poorly with a mean of 2.19, the analysis made by the figures for reliability of internet connection is necessitated by the fact that participants are from different regions of the county hence different areas had different signal strength thus some areas were well connected and others poorly connected, that is further proven by the high standard deviation of 0.890 which means the data points are spread out thus participants either were reliably connected or completely did not have reliable connection.

On data downtime disconnection which scored a mean of 2.19, this was a result of the application requiring massive data resources or available internet connection resources were not sufficient hence interruption of services thus the poor score. The availability of different internet vendors also scored an average score of 3.18; this is a result of diversity of the sample area where in some areas respondents did not have options of variety of internet connection vendors. In general, the respondents noted that a combination of connectivity factors greatly influenced their decision to implement the agricultural value chain enterprise solutions in agricultural production with a mean of 4.61.

From the above analysis, it is apparent that connectivity is one of the main factors of implementing agricultural value chain solutions in agricultural production. Besides, good connectivity guarantees usage of any electronic device that runs on a network and thus ensures seamless usage and reliability. Good connectivity must also come with good

connection infrastructure such as access and other supporting parameters such as speed, coverage, availability, reliability and supporting vendors to ensure continuity and optional channels of connection.

4.5 End-user training

The study sought to also establish the influence of end user-training on the adoption of the agricultural value chain enterprise solutions in agricultural production. The findings were recorded in the Table 4.6.

Table 4.6: End User-Training

End User-Training	Mean	Standard Deviation
There is a training schedule for new users	4.40	0.505
Training materials are available and accessible	4.28	0.523
The training program is comprehensive and sufficient	4.12	0.388
Training personnel are supportive	4.26	0.576
Availability of training influenced my decision to implement the agricultural ERP	4.10	0.295
Training gave me confidence to implement the agricultural ERP	4.79	0.410
In my opinion, availability of training has positively influenced maximum productivity from using the ERP	4.55	0.499
Training period/time influences my decision to implement the agricultural ERP	4.36	0.631

Findings from Table 4.6 show the importance of end user-training on adoption of agricultural value chain enterprise solutions. Confidence for adoption of the agricultural ERP as a result of training and availability of training for maximum utilization of the ERP rated highly as important factors for the adoption of the agricultural ERP with a mean of 4.79 and 4.55 respectively. Availability of training schedule for new users came in closely third with an equally high rate with a mean of 4.40 indicating majority of the respondents

were in agreement of the importance of it. Duration of the training period, training materials availability and supportive training personnel also ranked highly with a respective mean of 4.36, 4.28 and 4.26 indicating respondents equally agreed they were necessary attributes of end user-training to be considered for the adoption of the agricultural ERP.

Comprehensive training programs and availability of training also were rated as important attributes with a mean of 4.12 and 4.10 respectively indicating the respondents were in agreement that they are also important attributes for end user-training. From the above analysis, it is apparent that end user-training is one of the main factors of implementing agricultural value chain enterprise solutions in agricultural production. End user-training provides the skills and knowledge needed to effectively and efficiently use the agricultural ERP, end user-training therefore has to have supporting attributes like available training materials, qualified training personnel, comprehensive training programs among others.

4.6 Cost of Ownership

Cost of ownership was another important factor for the study. The researcher sought to establish the influence of cost of ownership on the adoption of the agricultural value chain ERPs in agricultural production. The study assessed the extent to which cost of ownership influences the agricultural ERP adoption and the results were summarized in Table 4.7

Table 4.7: Cost of ownership

Cost of ownership	Mean	Standard Deviation
Cost of electronic hardware is affordable	3.77	0.662
Cost of acquiring the application is affordable	4.64	0.482
The costs of the agricultural ERP training is manageable	4.29	0.525
The overall cost of operating the application is affordable	2.79	1.025
The cost of acquiring the agricultural ERP has better gains in the long run future of my business	4.50	0.590
The reasonable cost for using the agricultural ERP influenced my decision in implementing it.	3.36	0.886
I chose this agricultural ERP because costs were not an issue	3.76	0.591

The summary from Table 4.7 indicates why cost of ownership is of paramount importance when considering implementing an agricultural value chain enterprise solution. Cost of acquiring the application was rated as the highest attribute of the cost of ownership with a mean of 4.64 indicating majority of the respondents agreed that this attribute determines if they will acquire the agricultural value chain enterprise solution or not. The overall cost of acquiring the ERP compared to the future gains from its usage came second with a mean of 4.50 indicating that majority of the respondents were satisfied with the acquisition cost in regard to future gains from its acquisition. Cost of the ERP training came third with a mean of 4.29 translating that the costs were manageable.

Cost of electronic hardware acquisition had a mean of 3.77 indicating that the attribute is a challenge, this may be due to different income levels of the respondents. The cost of operating the ERP and cost as an attribute that influenced acquisition of the agricultural ERP had respective mean of 2.79 and 3.36 with a standard deviation of 1.025 and 0.886 respectively. This is as a result of different income levels thereby cost attributes of the two become a factor depending on one's income. The standard deviations of the two attributes

are higher compared to the others indicating respondents' feedbacks were widely spread suggesting different of opinion on the attributes. Respondents also agreed the costs of the ERP were not much of an issue with a mean of 3.76 and standard deviation of 0.591.

From the analysis, it is paramount to consider cost of ownership as one of the main factors of implementing agricultural value chain enterprise solutions in agricultural production. Cost of ownership has several attributes such as cost of hardware and software acquisition, training cost, operation costs among other attributes.

4.7 Demographic Characteristics

The researcher found it important to determine the extent to which different demographic characteristics are associated with the adoption of the agricultural value chain enterprise solutions and thus using the respondents demographic data collected on the first segment of the questionnaire the following question and responses were taken and summarized in table 4.8.

Table 4.8: Demographic Characteristics of Respondents

Demographic characteristics	Mean	Standard Deviation
The use of this technology system is friendly and convenient for all age groups	3.53	0.984
I am confident with the agricultural ERP because I relate it to my generation	3.30	0.992
The agricultural ERP system makes it easier to handle my farming projects easily regardless of my age	4.38	0.527
Education has made it easier for me to embrace the agricultural ERP and implement it	2.59	0.907
The agricultural ERP system is meant for the educated	3.45	0.789
	2.12	0.593
Technology is a preserve for men	4.30	0.460
My gender has no influence on my decision to implement the agricultural ERP solution.	2.12	0.788
I can comfortably operate any technology device	2.56	0.961
I have computer operational skills to use any software application		

From Table 4.8 above on influence of demographic characteristics on adoption of the agricultural value chain enterprise solutions, we can make several deductions. The respondents agree that gender has no influence on the adoption of the agricultural ERP with a mean of 4.30 contrary to what the literature review had suggested about gender bias on technology adoption, however more research should be undertaken. Majority of the respondents also refuted claims that technology is a preserve for men with a mean of 2.12, this suggests that technology was viewed as production tool contrary to the literature review which had suggested more women are averse to adoption of technology, more research should however be undertaken to debunk this statement .The age attribute on adoption of the agricultural ERP had mixed views, on the question of the use of technology

across all age groups got a mean of 3.53 and a standard deviation of 0.984 indicating that respondents views were widespread, this follows with the earlier data in which majority of the respondents at 54.79% were youthful and below 45 years of age. The importance of the agricultural ERP regardless of age scored high mean of 4.38 suggesting that the respondents regardless of age found the technology useful.

The question of generation and age creating comfort in the adoption of the agricultural ERP scored a mean of 3.30 and a standard deviation of 0.992 suggesting that the views were widespread, this might have been brought about by the fact that a sizeable part of the respondents were from age 46 years and above thus corresponding with the literature review which suggests that older people are less likely to get accustomed to the use of technology. On the issue of education on adoption of technology, the respondents gave a mixed view on agricultural ERPs being preserve for educated with a mean of 3.45, this suggest that adoption of the technology was relatively preserved for the educated in the community.

Given the higher novice levels of the respondents on IT competence as indicated earlier with 67.12% of the respondents being novice users, majority of the respondents agreed that they were not comfortable a technology device with a mean of 2.12. A further lower mean value of 2.56 was scored respondents suggesting they do not have enough skills to operate computer software Education level providing confidence to use the agricultural ERP scored a mean of 2.59 suggesting that majority of the respondents based on their education level were not confident to implement the agricultural ERP. From the analysis, it is evident that demographic characteristics have an influence on how technology is adopted among different segments of the population thus influences the way agricultural value chain enterprises solutions are implemented.

4.8 Adoption of the Agricultural Value Chain Enterprise Solution adoption Factors

A question to establish how important the respondents would rate the different factors as to how it influences their decision to implement the agricultural value chain enterprise solution was asked. The results showed that it was a close call between connectivity

(37.67%) and cost of ownership (39.73%) as the most significant factors in choosing to implement the agricultural ERP in agricultural production. End user-training was ranked third (17. 12%) and lastly demographic characteristics (5.48%). Table 4.9 illustrates the results.

Table 4.9: Ranking of Factors

Factors	**Frequency**	**Percentages**
Connectivity	55	37.67%
End user-Training	25	17.12%
Cost of Ownership	58	39.73%
Demographic Characteristics	8	5.48%
Total	**146**	**100**

4.9 Detailed Description of the Study Factors

The researcher proceeded to ask open ended questions on the four attributes which was intended to collect further information on how they influence the respondents on their adoption challenges of the agricultural ERP. Based on the responses, the researcher categorised their challenges based on mostly connectivity challenges as a result of lack of network infrastructure and income levels which affects their cost of operating the agricultural ERP. End user-training and demographic characteristics did not feature much on this section since training was being provided free of charge by the application vendor and was not much of a challenge. This is an indication of the different reasons as to why the farmers may adopt the adoption of the agricultural value chain enterprise solution.

CHAPTER FIVE
SUMMARY OF FINDINGS, DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1. Introduction

The purpose of this study was to investigate the factors influencing the adoption of the agricultural value chain enterprise solutions on agricultural production. The results of the study were presented and discussed in chapter four. This chapter summarizes the findings and conclusions drawn. Recommendations for action are made and areas for further research have been identified.

5.2. Summary of Findings

The findings are summarized in line with the study objectives which include independent variables like connectivity, End user-training, cost of ownership and demographic characteristics which were studied against dependent variable which was acquisition power.

5.2.1 Findings on Demographic Characteristics and Adoption of Agricultural Value Chain Enterprise Solutions

The study observed that demographic characteristics had significant influence on the adoption of agricultural value chain enterprise solutions. It was observed that demographic characteristics influences the way different segments of people in the society view the adoption of technology and hence influence the way adoption of the agricultural ERP is adopted. This supports the research theoretical models of how technology adoption influences adoption of the agricultural ERPs. Various attributes of demographic characteristics like gender, age, education and IT competence affect how the agricultural ERP is implemented.

The study however revealed that age and education had greater significance in implementing the agricultural value chain enterprise solution since the literature review

and the theoretical model stated that young people and people with intermediary to advanced education are more likely to take up technology. It was established that demographic characteristics should be studied and agricultural vendors take steps to sensitize their targeted clientele on how to adopt and integrate technology in their daily production activities this will make the acceptance and adoption of the agricultural ERP easier.

5.2.2 Findings on Connectivity and Adoption of Agricultural Value Chain Enterprise Solutions

It emerged that the connectivity had a significant influence on the adoption of agricultural value chain enterprise solutions. The study further established that all the aspects of connectivity including network coverage, internet speeds, steady network, availability of internet vendors and connection reliability have a significant influence on adoption of the agricultural value chain enterprise solutions. The study however revealed that internet speeds and internet network coverage were considered the most significant attributes of connectivity that influence users to implement the agricultural ERPs. Further, the study established connectivity was an important factor undertaken by the respondents before adopting the adoption of the agricultural ERP therefore good connectivity has a high influence on the adoption of the value chain enterprise solution.

5.2.3 Findings on end user-training and adoption of agricultural value chain enterprise solution

The study established end user-training had a significant influence on the adoption of agricultural value chain enterprise solutions. The respondents expressed that end user-training was vital for them to implement the usage of the agricultural ERP. It was established that various attributes of end user-training were important for the users to grasp and accept the adoption of the agricultural ERP and this included, available training schedule for new users, comprehensive training materials, comprehensive training programs, supportive training personnel and manageable training time periods. The study however revealed that availability of training schedule for new users and training to ensure maximum productivity from the agricultural ERP for their agricultural production were of

utmost significance to ensure that they reap maximum benefit and easily adopt the agricultural ERP. Further, the study established end user-training greatly influenced respondents to implement the agricultural ERP.

5.2.4 Findings on Cost of Ownership and Adoption of Agricultural Value Chain Enterprise Solutions

It was determined that cost of ownership had strong significant influence on the adoption of agricultural value chain enterprise solutions. The researcher established that cost of ownership was rated high in influencing the adoption of the agricultural ERP. This re-affirms with the view that cost is a factor for consideration in the deployment of any technological system or application since technology tools and structures carry significant costs.

It was further established that various attributes of cost of ownership were vital for the users to implement the agricultural ERP and this included, cost of the hardware and software purchase, cost of training, operational cost of the system, reasonable cost of maintenance and cost benefit factor of implementing the agricultural ERP. The study however revealed that cost of the software acquisition and cost of training were of a higher significance since this are the initial cost associated with implementing the agricultural value chain enterprise solution. It was established that cost of ownership should be made as reasonable as possible with the vendor of the agricultural ERP ensuring basic services and tools are provided so that users incur very little initial cost of acquiring and implementing the agricultural ERP.

The study established that the users of the agricultural value chain enterprise solutions agreed that the research attributes influenced their decision to implement the agricultural ERPs. This underscores the importance of putting into consideration connectivity, end user-training, cost of ownership and demographic characteristics in the adoption of the agricultural value chain enterprise solution. However the study also established cost of ownership ranked first ahead of connectivity and end user-training, with demographic characteristics coming last in the relative importance of the influencing factors. The study

further established that if the four factors of connectivity, end user-training, cost of ownership and demographic characteristics if well catered for, the users will quickly and efficiently implement and use the agricultural value chin enterprise solution. The study also established acquisition cost and connectivity are the leading factors that influence the adoption of the agricultural value chain enterprise solution.

5.3 Discussions of Findings

The findings tried to understand the four factors that influence farmers to implement the agricultural value chain enterprise solutions in agricultural production. The discussion of findings from this study is presented as follows**.**

5.3.1 Demographic Characteristics and Adoption of Agricultural Value Chain Enterprise Solutions

The study has established that the use of demographic characteristics had influence on the different segments of the society and how it influences the adoption of the agricultural value chain enterprise solution. It was realized that the segmentation of the different groups would help them comprehend how technology fits in their daily lives and how to integrate it in their daily activities to reap maximum benefits in their agricultural production projects. It was also noted that sensitization of the different groups by software vendors will help in measuring progress and prepare the farmers in Makueni County to embrace the agricultural ERP. Training of the farmers was deemed necessary to impart the skills of utilizing the agricultural value chain enterprise solutions.

5.3.2 Connectivity and Adoption of Agricultural Value Chain Enterprise Solutions

The study established that connectivity had a significant influence on adoption of agricultural value chain enterprise solution in agricultural production in Makueni County. The study also established that good network infrastructure would facilitate better connectivity within the county and thus improve the adoption of the agricultural ERP. It was also agreed that the application vendor should also be involved in ensuring that the farmers and users of the system are able to get hotspots where they can use the application in areas where network coverage is a challenge. The study findings are consistent with MIS

Report (2016) which asserts that a large proportion of the rural population, especially in the developing world, remains unconnected.

5.3.3 End user-Training and Adoption of Agricultural Value Chain Enterprise Solutions

It was established that end user-training had significant influence on adoption of agricultural value chain enterprise solution in agricultural production in Makueni County The respondents expressed that a good end user-training should be worked out and applied during the introduction of the agricultural ERP. Comprehensive training programs and materials should be provided and the need for supportive training personnel. It was also realized that there is need to create linkages between the comprehensive training programs to maximize productivity of the agricultural ERPs, available training hotspot and the training duration should be manageable to achieve this objectives. It emerged that supportive training personnel should be available to enhance maximum utilization of the agricultural ERP.

5.3.4 Cost of Ownership and Adoption of Agricultural Value Chain Enterprise Solutions

The study established that cost of ownership had a high significant influence on adoption of agricultural value chain enterprise solution in agricultural production in Makueni County. It was discovered that cost of ownership influenced whether the farmers would implement the agricultural ERP or not, this was either due to forecasted operation cost or acquisition cost. These findings were in line with those of Dixon et al, (2002) who suggested that most individuals will less likely adopt a technology system when its initial set-up cost is high. The study also found that the software vendor should ensure the initial cost of the technology application should be as low as possible for it to be accepted by its users.

5.4 Conclusions

Based on the findings of the study, the following conclusions are made on the factors influencing the adoption of agricultural value chain enterprise solutions on agricultural production in Makueni County. All the four attributes studied which include connectivity, end user-training, cost of ownership and demographic characteristics were found to influence the adoption of agricultural value chain enterprise solutions on agricultural production in Makueni County.

It was established that all the four attributes were found to be very important in implementing the agricultural ERP, although cost of ownership and connectivity were found to be highly ranked influencing factors. This is due to the fact that farmers consider cost of ownership and connectivity as vital in using the agricultural ERP since this is usually the set up challenge, without proper connectivity the system will not run and without enough resources the system will also be rendered unusable. The other two attributes can be relatively easy to change and manage but the ones highlighted are not in the ERP vendors' control. The study further concludes combining the four attributes and working on them will better the chances of the farmers adopting it their agricultural production projects and thus improve their yields and productivity in an efficient way.

5.5 Recommendations

The following recommendations are made based on the finding of the study.

The study further recommends that capacity building and sensitization with regard to different demographic segments should be undertaken to impart knowledge how to embrace the concept of the agricultural ERP among different farmers who have diverse demographic structure. The study established that ERP vendors carry out a feasibility study of their area of operation to determine connectivity and network infrastructure available to ensure smooth deployment of the ERP systems, consequently the study recommends that they should provide connectivity hotspots like Wi-Fi centers in areas where there is no enough network coverage.

The importance of end user-training is key in ensuring farmers gain full knowledge and skills in operating the agricultural ERP and also maximizes benefits. It is suggested that training should be a continuous activity so that farmers can learn new developments and master the way to utilize the agricultural ERP. The study established cost of ownership as a highly ranked factor in the adoption of the agricultural ERP hence the ERP vendors should make the initial acquisition cost as reasonable as possible, the software should be provided on a subsidized cost. It was suggested that the cost of training should be borne by the ERP vendor to encourage farmers to seek it. Wi-Fi hotspots should also be provided so that those who cannot afford to pay for active internet connection.

5.6 Suggestions for Further Study

Similar study should be carried to find out why non-adopters are not able to take up the use of the agricultural value chain enterprise.

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APPENDICES

APPENDIX I: LETTER OF TRANSMITAL OF DATA COLLECTION INSTRUMENTS

Tony Nzwii
P.O. BOX 88028
Mombasa

Dear Respondent

REF: REQUEST FOR INFORMATION

I am a post graduate student of university of Nairobi pursuing a program leading to Master of Arts degree in project planning and management. As part of the course I am expected to conduct a research on factors influencing the adoption of agricultural ERPs. This is to request you to participate in the exercise as a respondent. The information provided for this research will be purely for academic purposes and the recommendation made will be important to your project and the country as a whole. The information provided will be treated with utmost confidentiality.

Yours faithfully,

Tony Nzwii

APPENDIX II:

RESEARCH QUESTIONNAIRE

Please answer the following questions appropriately by either giving the required information or ticking ( ) appropriately.

PART I: BACKGROUND INFORMATION

Respondents No…….

Respondents Designation…….

1. **Gender**: Male ( ) Female ( )
2. **Age**: (A) 25 & Below (B) 26-35 (c) 36-45 (D) 46-55 (E) Above 56
3. **Level of Education**

(A) Primary [ ] (B) O-level [ ] (C) A-Level [ ] (D) Certificate [ ]

(E) Diploma [ ] (F) Graduate [ ] (G) Masters [ ] (H) P.H.D [ ]

PART II: The extent to which you feel connectivity influences the adoption of agricultural value chain value chain enterprise solutions in agricultural production.

Kindly indicate how much you agree/disagree with the following statements on a scale of 1to 5. (**1-** Strongly disagree**, 2-**Disagree**, 3-**Neutral**, 4-**Agree and **5-**Strongly agree):

2(a) In your own opinion, to what extent does the following influence connectivity in the adoption of agricultural value chain enterprise solutions in agricultural production

No	**Statement**	**Rating**				
		(1)	(2)	(3)	(4)	(5)
i	Network coverage is sufficient and covers most areas					
ii	Internet speeds can comfortably satisfy my needs					
iii	Internet connection is steady and never fluctuates					
iv	The internet data never disconnects while in use					
v	There are available alternative service providers for internet connection					

vi	It takes a shorter time to access my internet network connection					
vii	The availability of different reliable internet connection vendors influenced my decision to use the agricultural ERP					
viii	I considered connectivity in my decision to implement the agricultural ERP					

PART III: The extent to which you feel end user training influences the adoption of agricultural value chain value chain enterprise solutions in agricultural production

Kindly indicate how much you agree/disagree with the following statements on a scale of 1to 5. (**1**- Strongly disagree, **2**-Disagree, **3**-Neutral, **4**-Agree and **5**-Strongly agree):

3(a) In your own opinion, to what extent does the end user-training influence the adoption of agricultural value chain enterprise solutions in agricultural production

No	**Statement**	**Rating**				
		(1)	(2)	(3)	(4)	(5)
i	There is a training schedule for new users					
ii	Training materials are available and accessible					
iii	The training program is comprehensive and sufficient					
iv	Training personnel are supportive					
v	Availability of training influenced my decision to implement the agricultural ERP					
vi	Training gave me confidence to implement the agricultural ERP					
vii	In my opinion, availability of training has positively influenced maximum productivity from using the ERP					
viii	Training period/time influences my decision to implement the agricultural ERP					

PART IV: The extent to which you feel cost of ownership influences the adoption of agricultural value chain value chain enterprise solutions in agricultural production

Kindly indicate how much you agree/disagree with the following statements on a scale of 1to 5. (1- Strongly disagree, 2-Disagree, 3-Neutral, 4-Agree and 5-Strongly agree):

4(a) In your own opinion, to what extent does the cost of ownership influence the adoption of agricultural value chain enterprise solutions in agricultural production

No	**Statement**	**Rating**				
		(1)	(2)	(3)	(4)	(5)
i	Cost of electronic hardware is affordable					
ii	Cost of acquiring the application is affordable					
iii	The costs of the agricultural ERP training is manageable					
iv	The overall cost of operating the application is affordable					
v	The cost of acquiring the agricultural ERP has better gains in the long run future of my business					
vi	The reasonable cost for using the agricultural ERP influenced my decision in implementing it.					
vii	I chose this agricultural ERP because costs were not an issue					

PART V: The extent to which you feel demographic characteristics influences the adoption of agricultural value chain enterprise solutions in agricultural production

Kindly indicate how much you agree/disagree with the following statements on a scale of 1to 5. (1- Strongly disagree, 2-Disagree, 3-Neutral, 4-Agree and 5-Strongly agree):

5(a) In your own opinion, to what extent does the demographic characteristics influence the adoption of agricultural value chain enterprise solutions in agricultural production

No	Statement	Rating				
		(1)	(2)	(3)	(4)	(5)
i	The use of this technology system is friendly and convenient for all age groups					
ii	I am confident with the agricultural ERP because I relate it to my generation					
iii	The agricultural ERP system makes it easier to handle my farming projects easily regardless of my age					
iv	Education has made it easier for me to embrace the agricultural ERP and implement it					
v	The agricultural ERP system is meant for the educated					
iv	Technology is a preserve for men					
vii	My gender has no influence on my decision to implement the agricultural ERP solution					
viii	I can comfortably operate any technology device					
ix	I have computer operational skills to use any software application					

6. Which of these four factors would you consider to have the most influence on your decision to implement the agricultural value-chain enterprise solutions in your agricultural projects?

Connectivity [ ] End user-training [ ]

Cost of ownership [ ] Demographic characteristics [ ]

APPENDIX III

INTERVIEW SCHEDULE

1. How does connectivity affect your decision in implementing the agricultural value chain enterprise solution in your agricultural projects?

……
……
……

2. How does end user training structure affect your decision in implementing the agricultural value chain enterprise solution in your agricultural projects?

……

……

……

3. How does cost of ownership affect your decision in implementing the agricultural value chain enterprise solution in your agricultural projects?

……

……

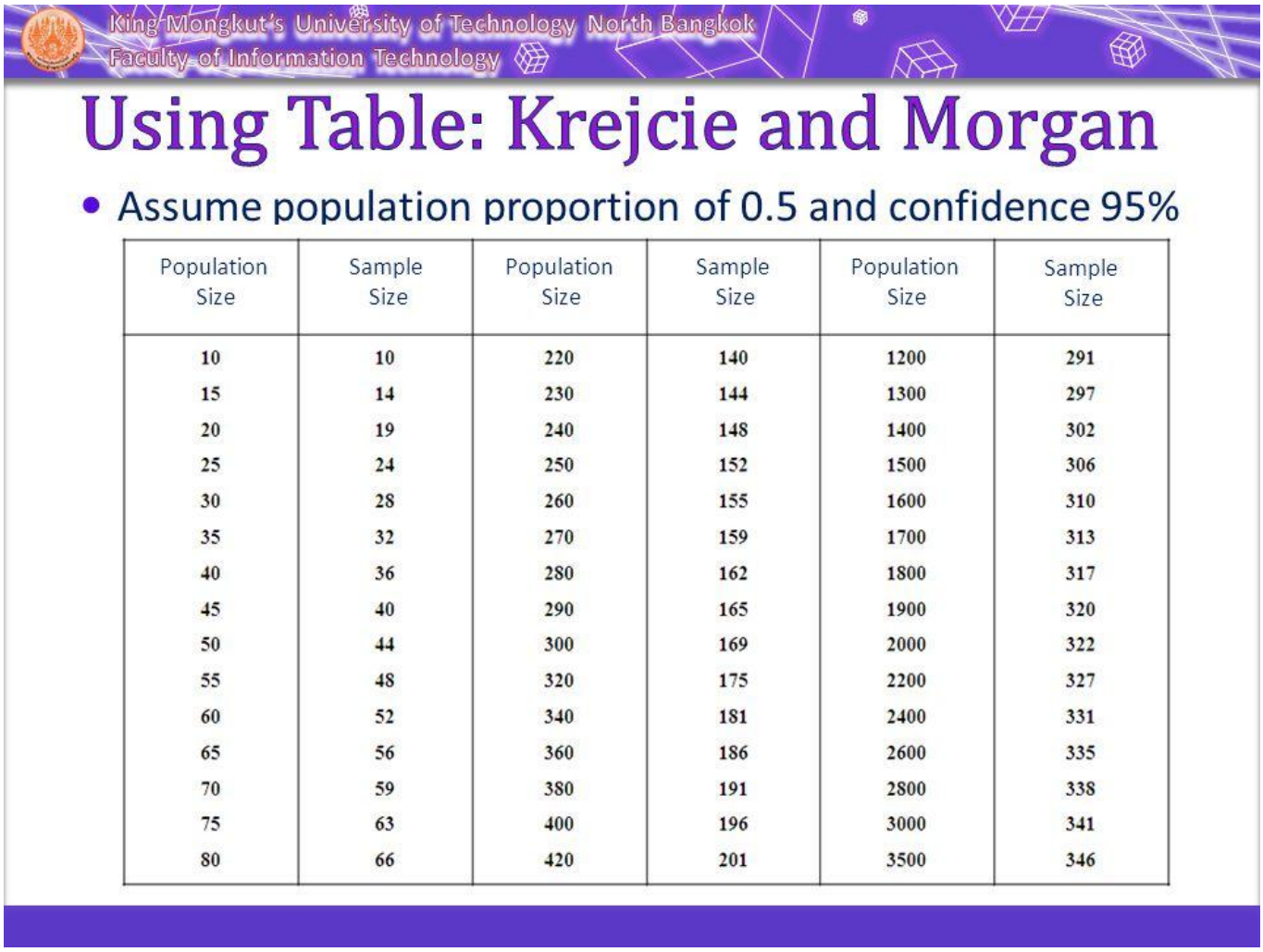
……

4. How do demographic characteristics influence your decision in implementing the agricultural value chain enterprise solution in your agricultural projects?

……

……

APPENDIX IV: KREJCIE AND MORGAN



Population Size	Sample Size	Population Size	Sample Size	Population Size	Sample Size
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346

Source: Krejcie and Morgan, 1970

APPENDIX V: PROJECT BUDGET

Project Budget Outline		**KES**
Project Personnel *		
Data collection staff		
Data clerk 1	500 kes/day*7 days	3500
Data clerk 2	500 kes/day* 7days	3500
Travel		
Travel in 6 sub-counties	1000kes/day*6 days	6000
Component Total		**13,000**
Training**		
In-service Training		
Rent of the training venue	1500kes*1venue	1500
Handout preparation	500kes*2personnel	1000
Transportation to the venue	500kes	500
Info sheets	500kes*2types(3copies each)	3000
Component Total		**10,000**
Equipment***		
Expendable Equipment		
Stationaries	150kes /196 copies*	29400
Component Total		**29400**
Miscellaneous		
Sundry and communications	2000kes*2 personnel	4000
59.00Component Total		**4,000**
Grand Total		**56,400**

APPENDIX VI: PROJECT TIMELINE

	Week 1	**Week 2**	**Week 3**	**Week 4**	**Week 5**	**Week 6**
Project proposal design & formulation						
Proposal Review						
Data collection						
Data Entry						
Data analysis and deduction						
Project summary						

APPENDIX VII:

ANTI-PLAGIARISM REPORT

FACTORS INFLUENCING THE IMPLEMENTATION OF AGRICULTURAL VALUE CHAIN ENTERPRISE SOLUTIONS IN AGRICULTURAL PRODUCTION IN KENYA: A CASE OF EDENSYS ENTERPRISE SOLUTION IN MAKUENI COUNTY.

ORIGINALITY REPORT

13%	10%	3%	7%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to University of Malaya Student Paper	<1%
2	Submitted to Africa Nazarene University Student Paper	<1%
3	www.ca.go.ke Internet Source	<1%
4	ictupdate.cta.int Internet Source	<1%
5	india.foodsecurityportal.org Internet Source	<1%
6	Submitted to Governors State University Student Paper	<1%
7	img.static.reliefweb.int Internet Source	<1%
8	worldwidescience.org Internet Source	<1%